MODEL AIRPLANE NEWS

FLY A KNIFE-EDGE CIRCLE

THE WORLD'S PREMIER R/C MODELING MAGAZINE

48120

April 1995

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APRIL 1995 VOLUME 123, NUMBER 4

MODEL AIRPLANE NEWS

FEATURES

ABOVE: *Dave Von Linsowe and his crew shown with Dave's Extra 300S with which he captured fifth spot at the '94 TOC. Dave was one of the 19 pilots who competed at this international event. Photo by Norm Staub.*

ON THE COVER: *Dave Von Linsowe's Extra 300S pulls up into a half knife-edge loop during a freestyle routine. Freestyle was one of the three scored events at the '94 TOC. Photo by Norm Staub.*

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

Model Airplane News (ISSN 0026-7295) is published monthly by **Air Age, Inc.**, 251 Danbury Rd., Wilton, CT 06897. Second-class postage paid at Wilton, CT, and at additional mailing offices. Subscription rates: $27.95 for 1 year (Canada, $43.82—includes G.S.T.; foreign, $40.95); $49.95 for 2 years (Canada, $81.27—includes G.S.T.; foreign, $75.95). **Postmaster:** send Form 3579 to **Model Airplane News**, P.O. Box 428, Mount Morris, IL 61054.

EDITORIAL

FRANK MASI

SLOW-FLIGHT DESIGN CONTEST EXTENSION

TO MAXIMIZE participation in the Slow-Flight Design Contest, we've extended the deadline to July 1, 1995, and relaxed some of the criteria for entering. If you've made progress toward building and flying an aircraft for this contest but have not met all the demands originally specified (a summarized re-statement of the rules was published in our September, '94 issue), you may still be eligible to win a cash prize and more!

This 3-channel (Cannon Super Micro radio), 7- to 8-ounce (depending on batteries) experimental electric represents a possible entrant in the indoor electric class of the Slow-Flight Design Contest. Designed by Russ Pribanic, it uses commercially available parts. Wingspan—36 inches; wing loading—3.1 ounces; covering—Micafilm. We'll tell you more about this design in a future issue.

The HY-70 motor, 8:1 gearbox and 6-inch prop are from VL Products, 7871 Alabama Ave., #16, Canoga Park, CA 91304. It uses 4- or 5-cell packs of either 225mAh or 180mAh batteries and an Astro 212 micro speed control with case removed.

The contest is sponsored by *Model Airplane News*, the NASA Langley Research Center, the NACA/NASA Alumni Association and Shapery Gyronautics Corp. Prize money totaling $6,250, provided by *Model Airplane News* and Shapery exclusively, will be paid to winners in three categories. The "floater" class includes internal-combustion-powered aircraft with wing loadings below 15 ounces per square foot: 1st prize—$1,000; 2nd prize—$500; 3rd prize—$250. The "conventional aircraft" class includes airplanes with wing loadings of 20 ounces per square foot or more: 1st prize—$1,500; 2nd prize—$825; 3rd prize—$425. The third class is indoor electric: 1st prize—$1,000; 2nd prize—$500; 3rd prize—$250.

For more information, contact Kate Doherty, assistant to the Group Editor-in-Chief, *Model Airplane News*, 251 Danbury Rd., Wilton, CT 06897; (203) 834-2900; fax (203) 762-9803; Internet address: kated@airage.com. We will be happy to provide a copy of the rules to interested parties. Entries should include a three-view, a description of the design and its performance, photos and a videotape of flight tests. If you plan to submit material, please let us know. Interest in this contest is high, and we hope to share a lot of interesting ideas on slow flight with our readers.

• **Midwest T-6 race update.** On September 8, 9 and 10, 1995, Frank Tiano's new T-6 organization will host the very first, all-Midwest T-6 race at the AMA's Muncie, IN, site. Look for entry information in our next issue. ■

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MODEL AIRPLANE NEWS (ISSN 0026-7295, USPS 533-470) is publis monthly by Air Age, Inc., 251 Danbury Rd., Wilton, CT 06897. Connecti Editorial and Business Offices, 251 Danbury Rd., Wilton, CT 06897. Phc 203-834-2900. FAX: 203-762-9803. Michael F. Doyle, Chief Execu Officer; Y.P. Johnson, President; G.E. DeFrancesco, Vice President; DeFrancesco, Secretary; Yvonne M. DeFrancesco, Treasurer. Second C Postage Permit paid at Wilton, Connecticut, and additional Mailing Offi

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AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

PLEASE NOTE

• In the February '95 issue, our Index of Manufacturers listed Hobby Lobby Intl. as the distributor of the CETO Mini R/C System. The system is also distributed by Hobby Club, 23141 Arroyo Vista, Ste. 210, Rancho Santa Margarita, CA 92688, and we would like to thank Hobby Club for supplying the unit that was reviewed.

• In the December '94 issue, we inadvertently omitted a photo credit for Tricia Cawley in the Stream Inc. Schneider Sport 60 article by Bernard Cawley.

STICKY SUBJECT

First, I find your magazine very illuminating and, in the future, I'm sure that your articles will be most helpful. I say "in the future" because 10 years ago, I spent quite a bit of time and money on R/C flying, and I thoroughly enjoyed the hobby. Circumstances forced me to move, and I had to get rid of all my equipment.

Recently, I decided to get back into the sport and, in discussing the construction of various models with members of the club, a question arose on which there were divergent opinions: you drill holes in the reinforced nylon engine mount only to realize that the holes should have been drilled, say, 3/8 inch farther forward or backward, depending on the situation. Here's where the difference of opinion comes in. Some say that there's no problem; just fill the first holes with epoxy. Others disagree, saying that the fuel will gradually "eat away" the epoxy and create a major problem down the line. Of course, the safe approach would be to get a new engine mount, but the major question is: how much effect does fuel have on epoxy?

I remember that when I was building my models, I would often "paint" a thin coat of epoxy on the interior of the fuselage to protect the balsa from fuel leakage. I'm confused and would appreciate any comments your experts might have on this question.

LEW CALAMITA
Peewee Valley, KS

Lew, welcome back to the fold; after 10 years, I'm sure there are a lot of new and exciting things happening in R/C to keep you completely hooked this time. As for the example you cite about filling holes in a reinforced-nylon (plastic) engine mount with epoxy, I agree that the safest approach is to buy a new mount and not use the damaged, weakened one. (I prefer one-piece, all-metal mounts for their rigidity and their ability to dissipate heat, but that's another issue.) Epoxy is a good fuelproofing agent, and almost everyone uses it to coat his model's firewall. Properly cured, it will probably outlive the rest of the model. The penetration of oil through the untreated, and especially the drilled, areas on the firewall is what damages the model's integrity. Epoxy will not add much, if any, strength to a drilled area on a plastic engine mount; epoxy does not adhere well to plastic. Also, since most plastics expand when they are heated, the size of the hole will constantly be changing, and this will further weaken the glue's chances of sticking to the engine mount. When it comes to operating a model aircraft safely, I would not make compromises regarding the engine mount. Epoxy is for wood and fiberglass, not molded plastic. GY

TODAY'S TRUE OLD-TIMERS

I first read *Model Airplane News* in the early 1930s and waited eagerly each month for the next issue. Then WW II, marriage, children, college, law school and a time-consuming career usurped whatever time I might have had to devote to building model aeroplanes (I like the English spelling; it gives the word greater meaning).

In recent years, however, retire-

ment has given me time for models, and I have again become an avid reader. The advancements in almost every aspect of the hobby—not the least of which are those in R/C—have been breathtaking. Others lie in design, materials and construction techniques. These and other advance-ments leave a model maker of the '30s somewhat confused as to the next move to make in what, at one time, was a simple procedure.

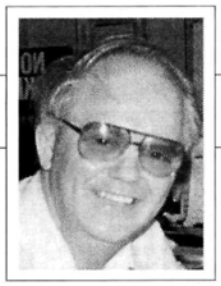
Model Airplane News is a pictorial of incredible models and countless articles relating to design, construction and flight. Amid these delights, however, I perceive a slight historical flaw. As far as you're concerned, "old timers" are those who date back to the '50s and '60s (with a slight bow to the '40s) and who built early R/C. It seems that, in your eyes, some enterprising chaps developed some radio equipment and then looked around to see what they could do with it: "Ah, I have an idea," one might have said. "Let's build a model aeroplane and place our R/C equipment in it. Now, how can we do that?"

The very opposite is, in fact, what occurred. In the mid-'30s, when I was about 12, modelers built gasoline-powered aeroplanes and dreamed of R/C—not that we would have had the funds to acquire the equipment. The engine itself was costly enough, but we dreamed anyway.

In those days, we built and repaired our models all afternoon and far into each night and then made our way to the local municipal airport on Sunday morning to fly them. The engines we used then seem to have drifted into oblivion. The first was the early Elf. Then came the Baby Cyclone, the McCoy, the OK, the stalwart Brown Jr. and the truly beautiful Ohlssons, as well as several engine kits that sold for some five or six dollars. The rudder was offset so that the aircraft would circle. Engines were often difficult to start and backfired on occasion; the craft was either hand-launched or permitted to take off from a runway or taxiway.

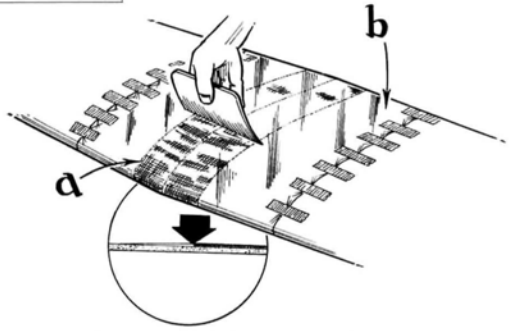
(Continued on page 125)

HINTS & KINKS



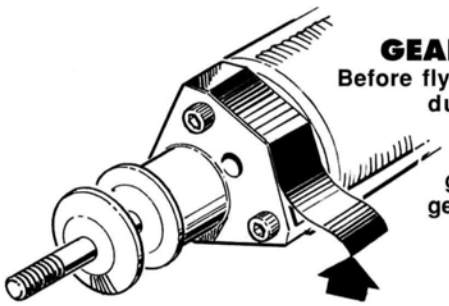
JIM NEWMAN

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



NO-SEAM TAPING

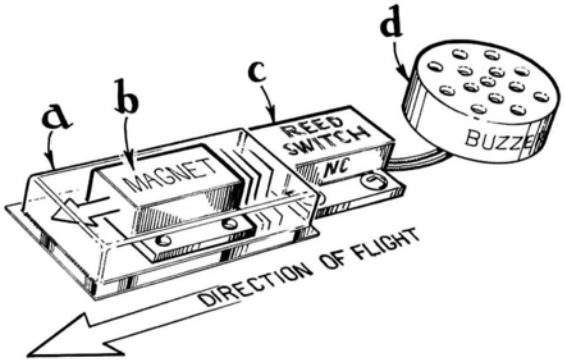
To prevent the edges of the resin and glass tape from forming a sharp ridge (a), cover the area with a large piece of plastic wrap or thin polyethylene (b) as soon as the resin has been applied, then tape the plastic down smoothly and tightly. Use your fingers and a plastic squeegee to press out any air bubbles, and blend the resin out to the edges, as shown in the magnified view. When the resin has cured, peel off the plastic wrap and lightly sand the area. ***Don Johnston, Jamestown, NY***



GEARBOX SEAL

Before flying over sandy or dusty areas, wrap vinyl electrician's tape around the gearbox to seal out gear-destroying grit.

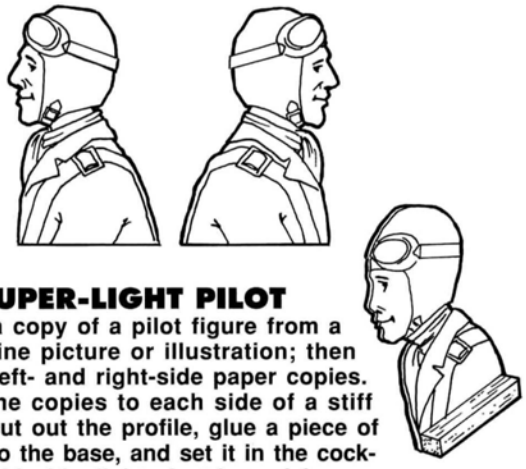
Ralph Evans, Tucson, AZ



INERTIA-SWITCH BUZZER

A high-pitched Sonalert or Radio Shack buzzer can locate lost models. It's operated by a simple inertia switch, and the housing (a) is a plastic X-Acto-blade package that contains a burglar-alarm window magnet (b) that's free to slide. The matching reed switch (c) is glued to the rear of the package. Before launch, place the magnet against the reed. When the model stops suddenly, the magnet jerks forward and operates the switch that sets off the buzzer (d).

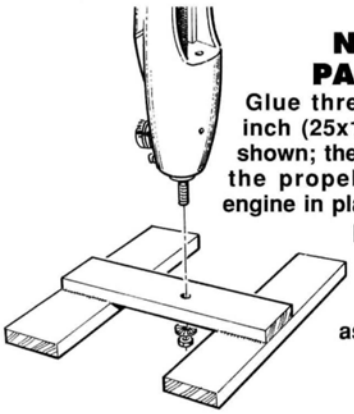
Euro Duncan, Rio De Janeiro, Brazil



SUPER-LIGHT PILOT

Make a copy of a pilot figure from a magazine picture or illustration; then make left- and right-side paper copies. Glue the copies to each side of a stiff card, cut out the profile, glue a piece of balsa to the base, and set it in the cockpit. It's ideal for light, electric models.

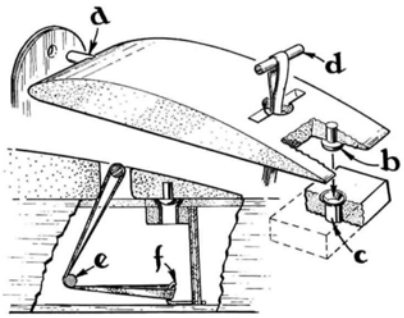
Levent Suberk, Bursa, Turkey



NO-HANDS PAINTING JIG

Glue three pieces of 1x4x24-inch (25x100x300mm) wood as shown; then drill the center to fit the propeller shaft. Wrap the engine in plastic, and use the propeller shaft to mount the model on the jig where it will be stable but free to rotate as you spray paint.

Bill Hessel, Stockton, MO

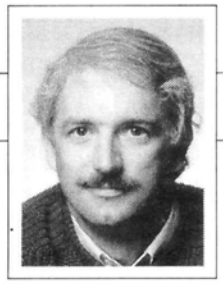


HIDEAWAY WING BANDS

The wing is secured at the front by the usual leading-edge dowel (a), but at the rear, it's fastened by a dome-head rivet or screw (b) that's seated in a short, flared brass tube (c), and snugged down by rubber bands that are looped over a recessed dowel (d) and pass around a transverse dowel (e) causing the wing to be pulled forward against the bulkhead. The wire hook (f) anchors the bottom ends of the bands. To attach the wing, use a simple wire hook to pull the bands up through the wing. Damage is avoided because, on impact, the rivet will disengage itself from the tube and allow the wing to slew.

Gordon Rae, Great Malvern, Worcs., England

AEROBATICS MADE EASY



DAVE PATRICK

THE KNIFE-EDGE CIRCLE

KNOWING ABOUT knife-edge flight is pretty important for aerobatic flight. Even in a simple roll, you pass through knife-edge briefly. When you perform a slow roll or a point roll, it really becomes important. In fact, being properly set up for knife-edge is extremely helpful to precision flying, and it really helps any time you apply rudder.

The main objective is for your plane to fly true when you apply rudder, i.e., you get only yaw as a result. To some degree, most airplanes do more than yaw when you input rudder. They usually roll with rudder or pitch with rudder, or even both. For example, let's say your plane does both. When you attempt a 4-point roll, first, you'll want your plane to roll right 90 degrees. You then apply left rudder to maintain altitude. In this case, however, your plane would roll on its own as if you had applied more aileron, and it would pitch as if you had applied elevator. The undesired pitching would, of course, pull or push you off heading. If your plane has this problem, even when you apply rudder in straight and level flight, the result will be the same.

My point is that even a sport flier should be concerned about this situation, because when a rudder command is called for, there should be no other unexpected results! Before you can delve into knife-edge, you have to ensure that your plane is responding properly to rudder input.

AVOIDING UNWANTED ROLL THE PLANE WAY

There are two ways to attack the problem: one is the trimming and design of the airplane; the second is to adjust the radio. Let's look at the plane first, which is the best way. We have two issues: how to fix rolling from rudder and how to fix pitching from rudder.

Dihedral has the strongest influence on how and if your plane will roll with rudder input, so having the correct amount of dihedral is critical. I can remember not too long ago—before we had the benefit of computer radios to trim out the roll in a pattern plane—I would take a saw and 5-minute epoxy to the flying field. I would then put in a test flight to determine my plane's rolling tendencies. If there was what we called "proverse roll," i.e., left rudder input resulted in a left-rolling tendency, there was too much dihedral. Conversely, if there was adverse roll, i.e., left rudder input resulted in right roll, there wasn't enough dihedral. So, out came the saw, the wing was cut, a dihedral adjustment was made and another test flight was made. It didn't take much. On a .60-size pattern plane, I would make adjustments of only ¼ inch, and there would be a surprising change. So if you decide to go this route, make small changes, and take careful notes.

One thing to point out here is that if you have a proverse-roll situation, it usually is proverse on both sides. In other words, both left and right rudder input results in a proverse roll. Adverse roll, of course, is when the plane rolls in a direction that's opposite to the rudder input. You may get proverse on one side and adverse on the other if there is a small amount of coupling. Why this happens I'm not too sure, but I like to adjust dihedral to split the difference so that the coupling is divided. Usually, on a good design that is well-built, this adjustment ends up as a very small amount. It doesn't have to be perfect. It's acceptable to me if, when you place your plane in the knife-edge position and apply rudder to sustain altitude, the aircraft rolls slightly.

Typically, the higher the wing is mounted on the aircraft, the less dihedral you will need; of course, the lower the wing, the more dihedral you'll need. That's why you see a lot of aerobatic planes with the wing near the midpoint of the fuse. Also, almost all biplanes have some proverse-rolling tendencies because the top wing is so high above the center line. I would like to point out there is no substitute for a well-built design. Most of the popular pattern ships are this way, including, for example, my Finesse design.

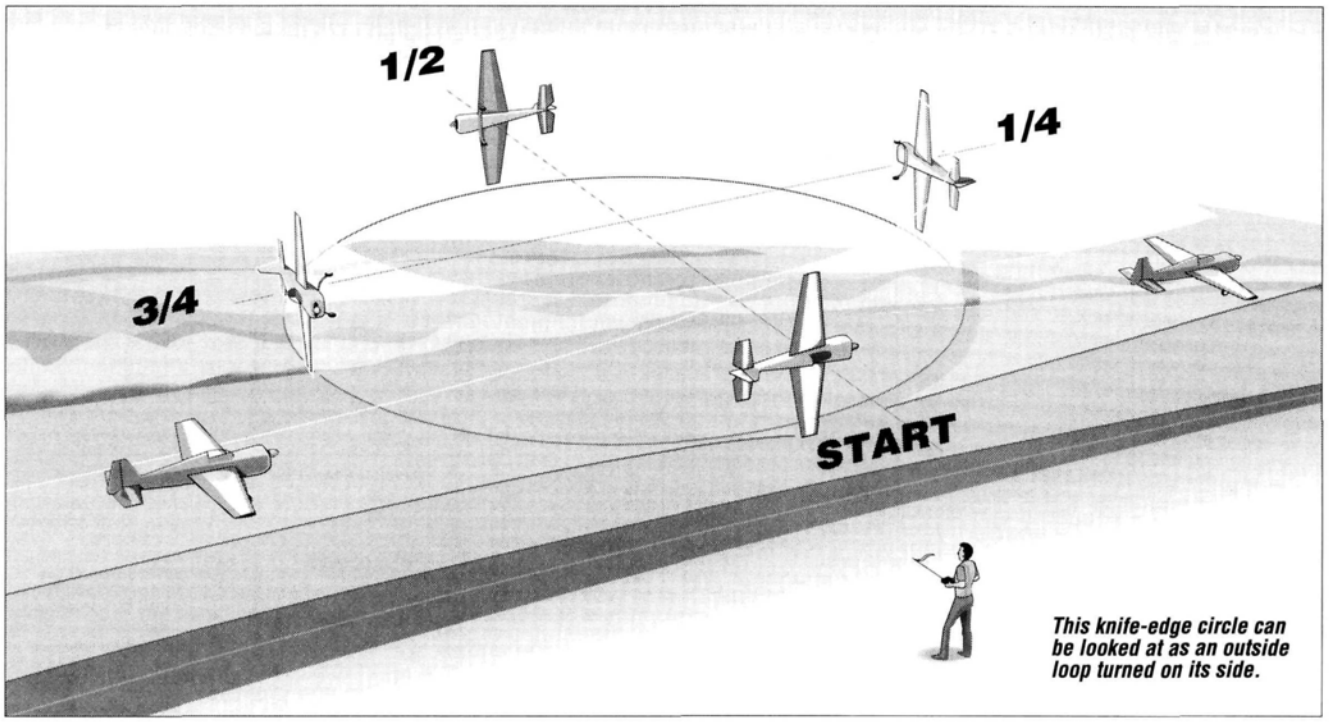
PROGRAMMING

With today's technologies, we can easily "fix" minor coupling with our fancy computer radios. Starting with a good design is a better solution, because fixing major coupling with a programmable radio can cause other problems. Nonetheless, it's not always practical to modify the aircraft to eliminate coupling.

For instance, at the TOC, our aerobatic planes had to be within a certain percentage of scale in outline. So, to compensate, we brought out our trusty computer radios and programmed a coupling, or opposing mix.

Note that when mixing, the rudder is the "master" and aileron is the "slave." It doesn't take much mixing. Typically, you're looking at mixing only a small amount—5 percent is a lot—so go easy when you start. For example, the Goldberg Ultimate takes only about 6 percent on a Futaba radio. These amounts are so small that it's hard to see it in control-surface movement. To help ensure that you're mixing in the correct direction, I find it really helpful to set the mix percentage to 50 percent and carefully observe the direction of the result of the mix. Then dial it down to about 5 percent or so.

If you're using separate aileron servos on separate channels, make sure you're mixing into both of them. Otherwise, only one aileron servo will be compensating. Consult your radio manual about mixing, as different systems do it differently. I'm sure you'll quickly discover how much better your pride and joy can fly!



This knife-edge circle can be looked at as an outside loop turned on its side.

ILLUSTRATION BY DALE TREECE

FIXING UNWANTED PITCHING

It's just as important to avoid unwanted pitching when rudder is applied. Again, there are two basic ways to approach this problem: adjusting the airplane or the radio. The airplane fix is always preferred. The reason why an airplane pitches with rudder is not fully understood, at least not by me, but what seems to have the strongest effects are the placement of the stab on the fuse, the CG location and the rudder hinge-line angle. Though adjusting the CG may seem like the easiest fix, doing so will affect other things so strongly that it isn't generally the best area to modify. But if you want to try changing the CG, moving it forward will make the plane pitch as if you had up-elevator in knife-edge, and moving it aft will make your plane tend to pitch down.

Now, changing the angle of the rudder hinge line is nearly impossible, so we will eliminate that. Still, you should understand that an aft sweep in the hinge line tends to make the plane pitch up with rudder input.

The higher the stab, the more pitch down you get with rudder and, of course, if the stab is mounted too low, the opposite can happen. Some pattern designs have an anhedral stab (surfaces are bent down) that produces the same effect as lowering the stab. Unwanted pitching can be eliminated by our modern radios by mixing it out as we did with rolling. The approach is the same, but note that, most of the time, a plane pitches in the same direction, and that means the slave channel (elevator) needs to be mixed in the same direction whether you input left or right rudder. Usually, the default selection gives you different directions, so please consult your manual. Also, the amount of mix is generally small, so I would again start with a 5-percent mix and see what happens.

KNIFE-EDGE CIRCLE

Now that you have your plane trimmed out so that it can knife-edge on either side straight and true, let's try a very interesting maneuver—the knife-edge circle. At this year's TOC, this was the entrance maneuver of my 4-minute free. This freestyle aerobatic sequence is devised by the pilot to demonstrate the plane's capabilities; it's usually accompanied by music and often entails smoke.

Quite simply, roll to knife-edge and apply a small amount of down-elevator to get the plane to turn 360 degrees. Since you have trimmed your plane so well, it will look effortless! Let's say you start from left to right and fly clockwise. Before you reach center, roll right 90 degrees, and apply left rudder to sustain knife-edge (you're now looking at the top of the plane). Then, as you pass center, apply a small amount of down to turn away in a large circle (you're basically performing a horizontal outside loop).

Here are a few pointers: start high—the first half of the maneuver seems easy. You'll find, however, that as the plane starts to arc back toward you, it's in an awkward perspective, and it will take some getting used to.

I find it much more impressive to turn outside using down-elevator. Keep in mind that your rudder is serving as elevator and that the elevator is now your rudder. Aileron remains the same. This maneuver does require practice, and you should learn to start from both directions. While it's not a "busy" maneuver, it can be very impressive, especially flown low and maybe with some smoke! ■

AIR SCOOP

CHRIS CHIANELLI

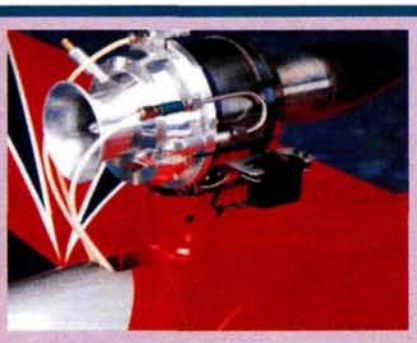
New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

Shape of Things to Come

This 6-foot-wingspan, 1/6-scale Shapery prototype VTOL was built and test-flown by Tom Hunt, who is under contract to Shapery Gyronautics Corp. The prototype is being used as a proving ground for a possible man-carrying 300- to 400-knot cruise version. The 18.25-pound model incorporates a fiberglass fuselage that's molded of CNC-machined plugs that Tom made himself. The flying surfaces are all hand-shaped out of blue foam and covered in Ultracote Plus.

The lift engine is an O.S. .90 ducted-fan engine swinging a Taipan 11x5 prop in a divergent 11- to 12-inch duct (the duct is 11 inches in diameter at the prop and 12 inches in diameter at the bottom exit of the fuselage). This combination at 19,000rpm generates more than 23 pounds of thrust! The cruise engine is an O.S. .46 ducted-fan engine swinging a Zinger 10x5 in a shroud, and it should develop nearly 10 pounds of thrust. Tom hopes that this setup will execute outbound transitions with sufficient thrust to get the model on the wing.

The Shapery is controlled by a Futaba Super Seven transmitter, a DAD Interceptor 2000 receiver and 13 DAD servos of various sizes. Two Futaba G-154 gyros stabilize the pitch and roll axes during hover. Roll control during hover is achieved using two semicircular doors below the lift engine. Pitch and yaw control are obtained from vanes in the cruise engine's propwash. The cruise engine is run at approximately three-eighths to one-half power while in hover. The lift engine is throttled normally for ascent and descent. The lift fan is tipped slightly forward in the fuselage to offset any thrust from the high-idling cruise engine. For further information, contact Dave Abbe (Vice President), 1780 E. Chase Ave., El Cajon, CA 92020; (619) 447- 6146.



A Closer Look

In the February '95 issue, we showed you Airtronics' new J-450 turbine engine. The photo—a small black-and-white shot—was less than inspiring. I thought the product warranted a closer look in color. The 4-pound J-450 produces 11 pounds of thrust at 123,000rpm, and it's 14.4 inches long and 4.8 inches wide. Here's the best part: the unit starts with compressed air and runs on JP-4 fuel instead of propane. Much safer. For more information, contact Airtronics Inc., 11 Autry, Irvine, CA 92718; (704) 830-8769.

Like Home-Cooked

It appears that Kyosho is venturing into a new market—one many fliers would love to see them succeed in: all-wooden ARFs of scale subjects.

There are many good-looking, fine-flying scale ARFs out there. Wooden ones that feature construction techniques very similar to those found on conventional all-wood kits are definitely in the minority. Let's face it: a modeler feels much more confident repairing an ARF that's all wood and put together in a familiar way. Many ARFs use materials with which modelers do not feel comfortable working. This new J3 Cub will be available in two versions: uncovered and covered in a very scale-looking fabric (not shiny plastic).

Specifications: wingspan—71.7 inches; wing area—760 square inches; weight—5.5 pounds; wing loading—16.6 ounces per square foot; engine requirements—.30 to .35 2-stroke, or .48 to .53 4-stroke. Rumor has it that the covered version will cost about $250 and the uncovered version will cost $200. Stay tuned. For more information, contact Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-3630; fax (217) 356-6608.

Here's the latest from EZ OK Model Co.—an F-82 or, as some call it, the "Twin Mustang." The EZ F-82 has a 63.4-inch wingspan, and it requires two .25 2-stroke engines. It weighs in at 7.2 to 7.7 pounds, and it features the famous triple-skin ARF construction that EZ pioneered. Because of the close proximity of the engines, compared with other twins that have their engines separated by a central fuselage, the F-82 design is reported to have superior "one-engine-out" handling characteristics.

Fast in the Shop; Fast in the Air

& Altech Irvine

Altech Marketing is now the exclusive distributor of the fine line of Irvine engines. I consider this very good news. I've owned a .40 and a Q40 (shown) and found them very reliable, powerful engines with low vibration levels. Altech will bring the same level of customer service and parts availability to this line as they have to Enya engines.

Besides the quiet Q40 ABC (85dB at 9 feet at 11,000rpm on an APC 10x9 prop), which develops considerable torque at modest sport-flying outputs of approximately 10,500 to 12,000 rpm, Altech will also distribute the new 1.50RC 2-stroke and the new Q72 ABC for modelers who need greater engine power and displacement at similarly modest sound levels. Once again, the Q72 has been designed for low-rpm, high-torque operation, and it really excels with large propellers, such as the APC 14x8. It will turn this massive propeller effortlessly at just over 9,200rpm without overloading or overheating. Look for the full line of powerful, high-quality, yet reasonably priced, sport and specialty aircraft engines. For more information, contact Altech, P.O. Box 391, Edison, NJ 08818-0391; (908) 248-8738.

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1995. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

FLASHY FUN FLIERS

These R/C'ers from Curaçao—an island that belongs to the Netherlands and is off the coast of Venezuela—show off their NOTFORSALE models. Club secretary Dirk van Zuidam tells us that Curaçao is nice and sunny with year-round temperatures in the 80s and a steady northeasterly wind that averages 15 knots. The NOTFORSALE models have been a great hit; the pilots just leave the engines in idle, and the models hang in the air until they run out of fuel.

FLYING LANDSCAPE

Ricky Gosnell of Orlando, FL, used oil paints to hand-paint this ¼-scale Bridi Bizzee Bee. The 96-inch-span model weighs 25 pounds and is powered by a Zenoah G-45 turning a Master Airscrew 20x10 prop. Ricky says that he has been flying for more than 31 years and that his Bizzee Bee is "one sweet airplane." We think that it's almost too pretty to fly, Ricky!

HUNTER IN THE GRASS

Luis Miguel Sánchez Matienzo of Mexico scratch-built this ME-109E Galant from Brian Taylor plans. The balsa-and-ply model is powered by an O.S. Max motor with a Tatone muffler and Rhom-Air retracts. Using a Bob Holman photo pack as a guide, Luis finished the model with silk and dope and K&B paints. This is his first scratch-built model—well done!

ST. CLOUD SEAFIRE

Robert Greer of St. Cloud, FL, says that, although he "doesn't fly worth a darn," he enjoyed building this first prototype of the Spitfire Mk V floatplane from a Pilot kit. The registration number and the markings are correct, and the fun-scale model is actually very close to the proper scale dimensions. The floats are from Stream Aviation.

CONSTRUCTION

JET-LIKE PERFORMANCE IN A 1/2A PACKAGE

by MICHAEL VAN STAAGEN

The author with his Microjet II—a 25-inch-long, jet-like craft powered by a Cox .049 engine.

IN 1987, I visited a friend at my school's aerospace engineering lab during the final days of a .60-size, senior-design construction project. I noticed that they were creating a rather large model and a rather large pile of scraps. Never one to let an opportunity pass by, I acquired the seemingly useless balsa to use in my next project. As a student of architecture, I have always been fascinated with the "less is more" principle.

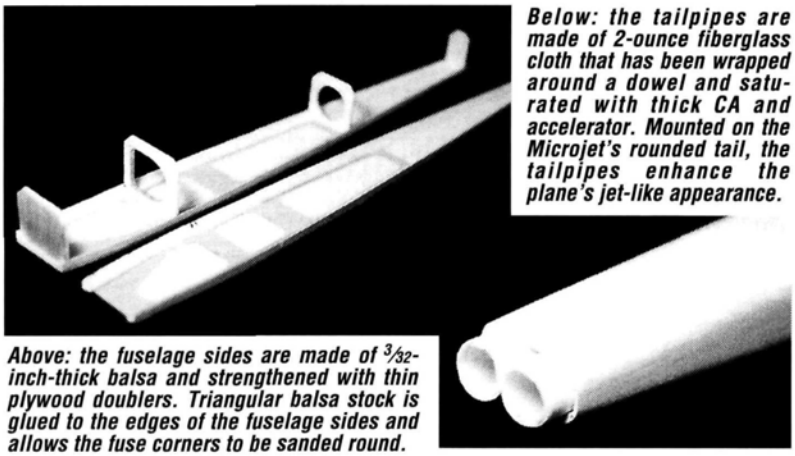
Unfortunately, this also happens to be my wallet's favorite principle. With the dreams of a new kit behind me, I took inventory of my modeling supplies and ended up with a 7-channel radio sporting full-size radio gear; an old, but well-running, Cox TD .049; and a lot of junk in the hardware, covering and scrap-balsa boxes. I now faced the familiar problem of converting these components into a fierce, screaming, wild and exhilarating model airplane for about 20 bucks...yeah, right!*

THE MICROJET

I began by laying the components on the table. First came the .049, then the 2-ounce tank and the battery, a couple of servos, the receiver and the switch. Now, about that plane: what if I scaled that screaming jet down to a size that would simply encompass the needed components? Could I do that? I ended up with Microjet I—a tiny, 20-inch-long plane with a 16-inch wingspan and a dry weight of 16 ounces.

The first flight was most embarrassing; the plane was barely controllable. I flew it through an oak; its small size allowed it to pass most of the way through only to catch the very last

MICROJET II



Below: the tailpipes are made of 2-ounce fiberglass cloth that has been wrapped around a dowel and saturated with thick CA and accelerator. Mounted on the Microjet's rounded tail, the tailpipes enhance the plane's jet-like appearance.

Above: the fuselage sides are made of 3/32-inch-thick balsa and strengthened with thin plywood doublers. Triangular balsa stock is glued to the edges of the fuselage sides and allows the fuse corners to be sanded round.

branch, and that sent it spinning in pieces to the ground. Additional flights and investigation into the design revealed a few design problems. The 31.37 ounces per square foot wing loading was too high, and the sharp, knife-like leading edges on all flying surfaces caused the air to prematurely separate at high speed and create a stick-jamming, turf-snatching situation, if you know what I mean.

A couple of years went by, and it was time to try this design again. The results yielded Microjet II. I enlarged the wing area to reduce the loading to 20 ounces per square foot, and I thinned the wing to a minimum dimension by incorporating an aluminum arrow shaft for the spar. I then re-sized the tail feathers to balance everything out. The new version is about 30 percent larger, yet it still weighs in at 16 ounces dry. It uses two standard servos, or three microservos, a 7-channel receiver and a 250mAh battery.

FUSELAGE CONSTRUCTION

Begin by cutting the fuselage sides out of 3/32-inch-thick balsa, leaving an extra 1/4 inch of length at the firewall for future alignment and trimming. Mark the hole for the aluminum spar, but do not cut it out at this time. Make the 1/64-inch-thick plywood doublers next. Cut out all the holes, except the one for the spar. Once the fuselage and wings are complete, make the spar holes. Laminate the doublers to the fuselage sides with thick CA. Then glue 1/4-inch triangular balsa stock to the top and bottom edges of the fuselage sides, and stay even with the fuselage edges as shown on the plan in the "typical section."

Cut out the fuselage bulkheads, orienting the grain as shown on the plan. F-1 is made of 1/8-inch-thick lite-ply, and the rest of the formers are of 1/8-inch-thick balsa. Make several 3/16-inch-wide strips of 1/64-inch-thick lite-ply, and cut across the grain so they can be easily bent. Glue these strips to the inside edge of the holes in F-2 and F-3. Now is a good time to make sure that your tank will fit through the finished hole in F-2. The hole is designed around a 2-ounce, round Sullivan* tank.

Begin joining the bulkheads to the right fuselage side; start with F-2, followed by F-3 and F-4. Tack F-1 to the right fuse side with a drop of CA, and remember to position it 1 1/2 degrees downward as shown on the plan. Next, join the bulkheads to the left fuselage side in the same order, and make sure

SPECIFICATIONS

Wingspan: 21.5 in.
Weight: 16 oz. (dry)
Length: 24.31 in.
No. of channels required: 2 or 3 (elevator, ailerons, optional rudders)
Radio used: Futaba* FG-Series 6-channel
Airfoil type: symmetrical
Wing area: 115.11 sq. in.
Wing loading: 20.01 oz./sq. ft.
Engine used: Cox TD .049
Engine recommended: .049 to 051 2-stroke
Wing construction: balsa ribs with plywood and balsa capstrips; 1/32-inch balsa LE sheeting; aluminum-arrow shaft spar.

FLIGHT PERFORMANCE

• Takeoff and landing

The plane is hand-launched (best done after a brisk run) at an upward angle of 10 to 15 degrees. When launching by yourself, a couple of clicks of up-trim will help to keep the nose up until you can get your hand on the stick. Remember to mount the prop so that it will be horizontal when it meets the compression stroke where it will stay while you land. Landing takes place when the fuel runs out, and it is best to anticipate this and gain a little altitude beforehand. Glide speed is good and results in a very flat glide. Experienced pilots will have no problem placing Microjet II at their feet every time.

• Slow-speed performance

The only time Microjet II is slow is during climb, gliding and stall. During climb and right up to stall, Microjet is extremely stable and controllable. During power-on stall, it will usually drop off to the left and nose-down up to 45 degrees because of torque and the sweepback in the wing's leading edge. Stall-over is usually instantaneous because the model accelerates rapidly at any nose-down altitude. During the glide into landing, glide speed is best kept high through all the turns to final, and all speed should bleed off during the flare prior to touching down at full up-elevator and near stall. With the engine off, stall results in a very straight, wings-level attitude with a marked increase in descent rate. Once the engine quits, I usually flick off the dual-rate only on the elevator to get a little more elevator travel for the flare. When Microjet is all dialed in and into the wind, touchdown occurs at about 20mph, and it will slide about 5 feet in 4-inch grass. It can be safely landed in about any height of grass.

• High-speed performance

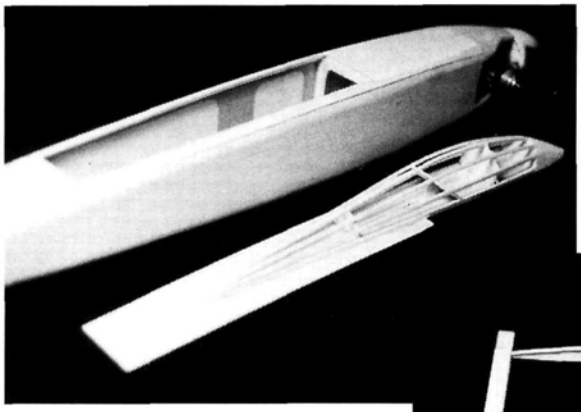
It's important that your TD .049/.051 is putting out good power. Using a 5.7x3 prop, anything over 17,000rpm will result in thrilling performance and real speed. It will also take a while for your fellow fliers to get used to the idea that you're passing them by with an .049-powered plane. When pointing the Microjet straight down, it has a tendency to return to normal flight attitude. Generally, the faster the dive is, the more nose-down elevator is needed to continue on a straight flight path. A word of caution: Microjet II is very small, and the perception of speed is amazing. It, therefore, is very important to keep the model where it can be seen well, and a complementing, contrasting color scheme is recommended for the top and bottom for better recognition.

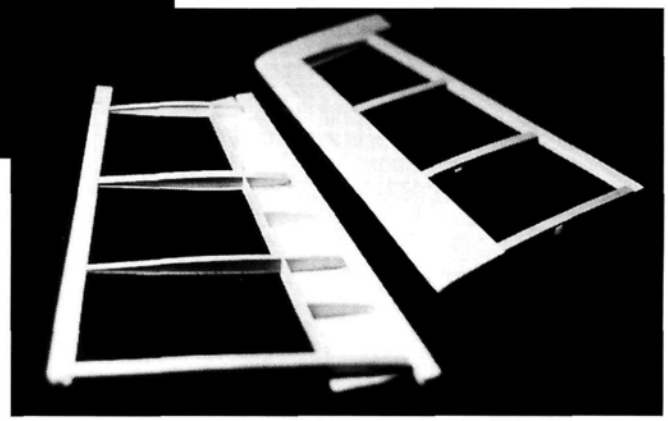
• Aerobatics

Aerobatics are only limited by the wide-open throttle and your imagination. Even with full power, stall turns are very nice and very predictable for a small model. All major maneuvers from avalanches to snap rolls are easily accomplished with a little practice to tailor your technique. While continuous knife-edge flight isn't possible, models equipped with rudders will be able to considerably extend those 4- and 8-point rolls. Because of the thrust angles and incidences, a trimmed Microjet II does require a medium amount of nose-down elevator in the inverted position.

• Durability

The Microjet is a tough cookie for its weight. During a hand launch, and by mistakenly using a helicopter radio without disabling the invert switch, I nosed it straight in with a backward-operating elevator. Both wings popped loose, one wing spar broke through the bottom of the wing by splitting the ribs, and the bottom balsa sheeting cracked. The hit was so hard that it bent the crankshaft in the Cox 049. Because the wings are only held on by gluing the adjacent rib to the fuselage, lots of kinetic energy was absorbed with their departure. The spar was put back into the ribs, the ribs were glued back together, the wings were re-glued to the side of the fuselage, the balsa sheeting was glued from the inside, a new crank was installed and, with a little MonoKote work, I was flying again.



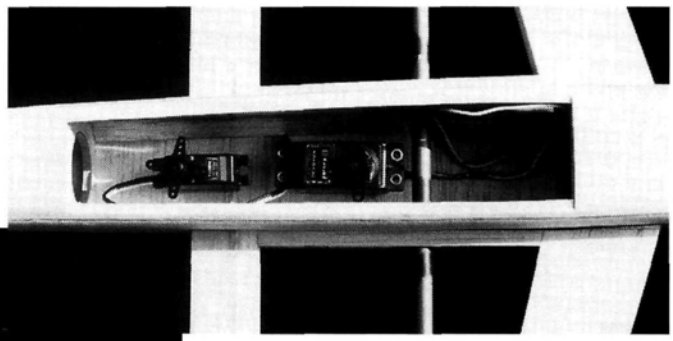


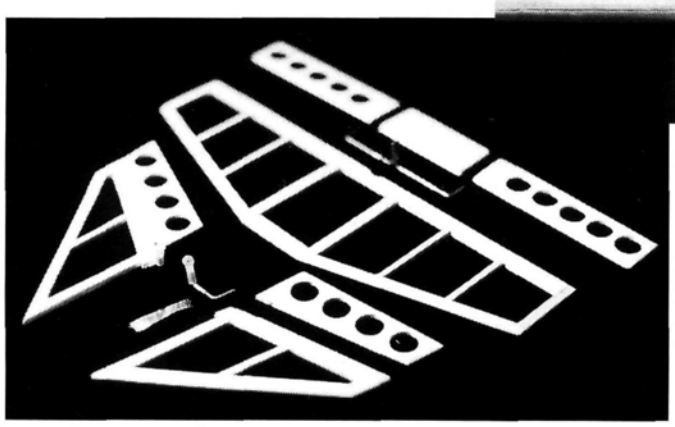
The canopy, which is formed with bulkheads and stringers, is attached to the hatch. The front of the canopy must conform to the slight curve of the fuse, so careful forming is necessary. Right: The 3/32-inch-thick balsa ribs are strengthened by a unique middle cap made of very thin plywood. An outer cap made of 1/32-inch-thick balsa is applied over the plywood cap.

that everything is square with the plans. Before gluing F-1, hold the front of the fuse with a rubber band to pull the sides together. Now align F-1 to the top and side views on the plans, and glue it into place with thin CA. F-1 should provide the engine with 1½ degrees of downthrust and sidethrust. Sand the fuse sides flush with F-1, then gently sand the top and bottom, squaring and smoothing the assembly. Sheet the bottom of the fuse with 3/32-inch-thick balsa (cross-grain), and leave the rear hatch open. Tack the hatch in place until the final sanding has been completed. Install the triangular balsa stock on the sides and bottom of the firewall. Cut a 1/64-inch-thick, lite-ply bottom doubler that's just big enough to fit between F-1 and F-2 (within the edges of the tri-stock). Glue the doubler into place with thick CA.

Using the center lines shown on the plan, temporarily attach the engine mount and the engine to the firewall. Draw the inside boundaries of the mount on the firewall, and route the fuel tubing through the firewall. Once the mounting screws have been removed, affix the blindnuts with CA. Assemble the fuel tank, and check that it works properly; then install it, supporting it with thin foam on the sides and bottom only. Remember to leave enough room for the battery. Using 1/16-inch-thick balsa, sheet from the nose back to F-2 and from F-3 to the aft end. Make the top radio hatch out of 1/16-inch-thick balsa. Two 7-inch strips of 1/8-inch-square balsa are glued to the underside of the hatch. These will help to hold the hatch to its final, curved shape and will key the hatch to the fuselage. (See the hatch section on the plans.) Tack the hatch into place for removal later.

Reinstall the engine mount, and bend the fuel tubing carefully to allow you to mount the engine. The fuel tubing will fit between the front of the mount and the engine's backplate. Install the blocking and the 1/4-inch tri-stock around the motor, and shape them so they blend smoothly with the spinner. Sand and shape the entire fuselage as shown on the plans. To make the tailpipes, wrap a 5/8-inch-diameter dowel with wax paper, coat the wax paper with CA accelerator, and wrap the dowel with 2-ounce fiberglass cloth. Saturate the cloth with thick CA, and quickly wrap it with wax paper that has been sprayed lightly with CA accelerator.





Above: a wing spar made out of an aluminum arrow shaft is passed through the fuselage and connects both wing assemblies. Left: the Microjet's tail feathers are made of various widths of 1/8-inch-thick balsa. The rudders and elevators are made of 1/8-inch-thick balsa sheeting with lightening holes made with a sharpened brass tube.

CANOPY AND HATCH

The 1/32-inch-thick balsa canopy base is glued to the hatch. Tack the front of the canopy base to the front blocking, then cut out and install the front and rear canopy blocking. Carve the underside of the front blocking so that, once it has been glued into place, it will force the canopy base to conform to the curved fuselage top. After cutting out the canopy bulkheads and installing them as shown (don't scallop C-2), install the 3/32-inch-square balsa stringers, and sand the blocking to shape. Former C-2 is a good place for a covering overlap joint. Remove the canopy and hatch assembly from the fuse, and install the rear hold-down pins. A piece of 3/32-inch-thick balsa that has been glued flush with the rear hatch edge and holds two round toothpick ends works well. Once holes have been made in F-3, strengthen them with thin CA. The front of the canopy is held down with a 2mm screw and a locknut. Embed the locknut in the fuselage nose blocking, and recess the 2mm screw head in the front canopy blocking. A small washer glued into the bottom of the recess will keep things tight.

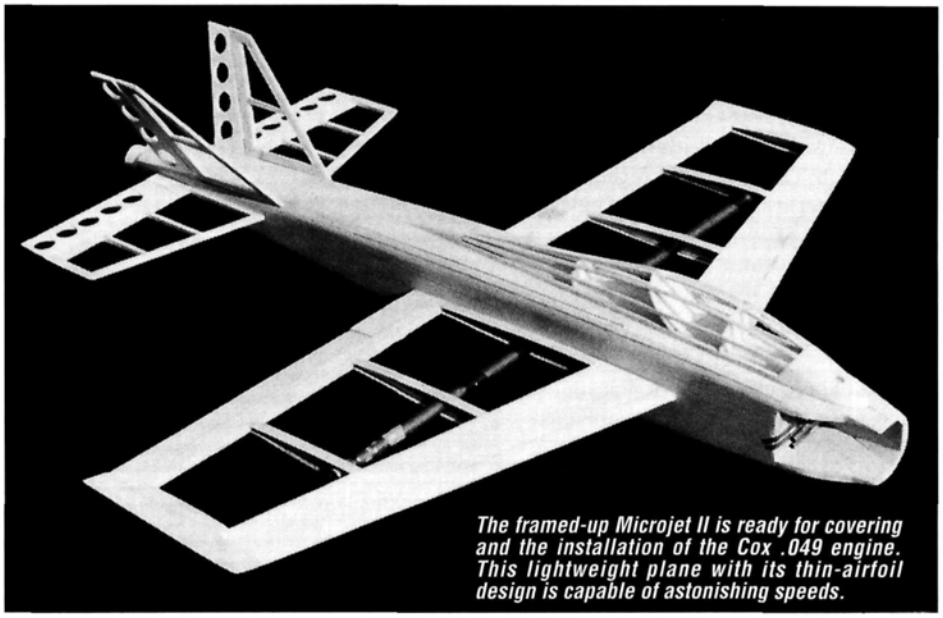
WINGS

The wing panels are identical, so I will describe how one side is made. To save weight and increase strength, the wing is built in a slightly unconventional manner: 1/64-inch-thick ply is sandwiched between the rib and the rib cap and at the trailing edge (see plan details). In addition, an aluminum-alloy arrow shaft—commonly available at discount department stores—is used as a spar. This type of alloy is stronger than standard aluminum stock.

To start construction, cut the 3/8-inch-

wide trailing edge out of 1/16-inch-thick balsa. The trailing edge should taper in width. The leading edge (LE) is made of 1/4x3/8-inch balsa, and the ribs are cut out of 3/32-inch-thick balsa. Mark the spar-hole positions on the ribs, but do not cut them out yet. It's also a good idea to mark the center line on both sides of the LE for rib placement and later LE shaping. Use CA to glue the ribs to the leading and trailing edges. You'll need a series of 1/4-inch-wide strips of 1/64-inch-thick ply to cap the ribs and 3/16-inch-wide strips for the trailing edge (TE). Cap both sides of the TE, and be sure to keep the ply flush with the TE rear edge. Cap the ribs on the top and bottom. Start at the back of the LE, and end in the middle of the TE. When you cap rib R-1, bend the rib to follow the curve of the fuselage.

Sheet the bottom of the LE with 1/32-inch-thick balsa. Install the 1/16-inch-thick half ribs and shear webs, then sheet the other side of the LE. Cap the TE with 1/32x3/8-inch balsa strips and the ribs with 1/32x1/4-inch strips. The aileron stock is constructed by laminating a strip of 1/64-inch-thick ply to a strip of 1/8-inch-thick balsa, which is then tapered to shape. This design prevents the thin aileron from deflecting during flight. Temporarily tape the aileron

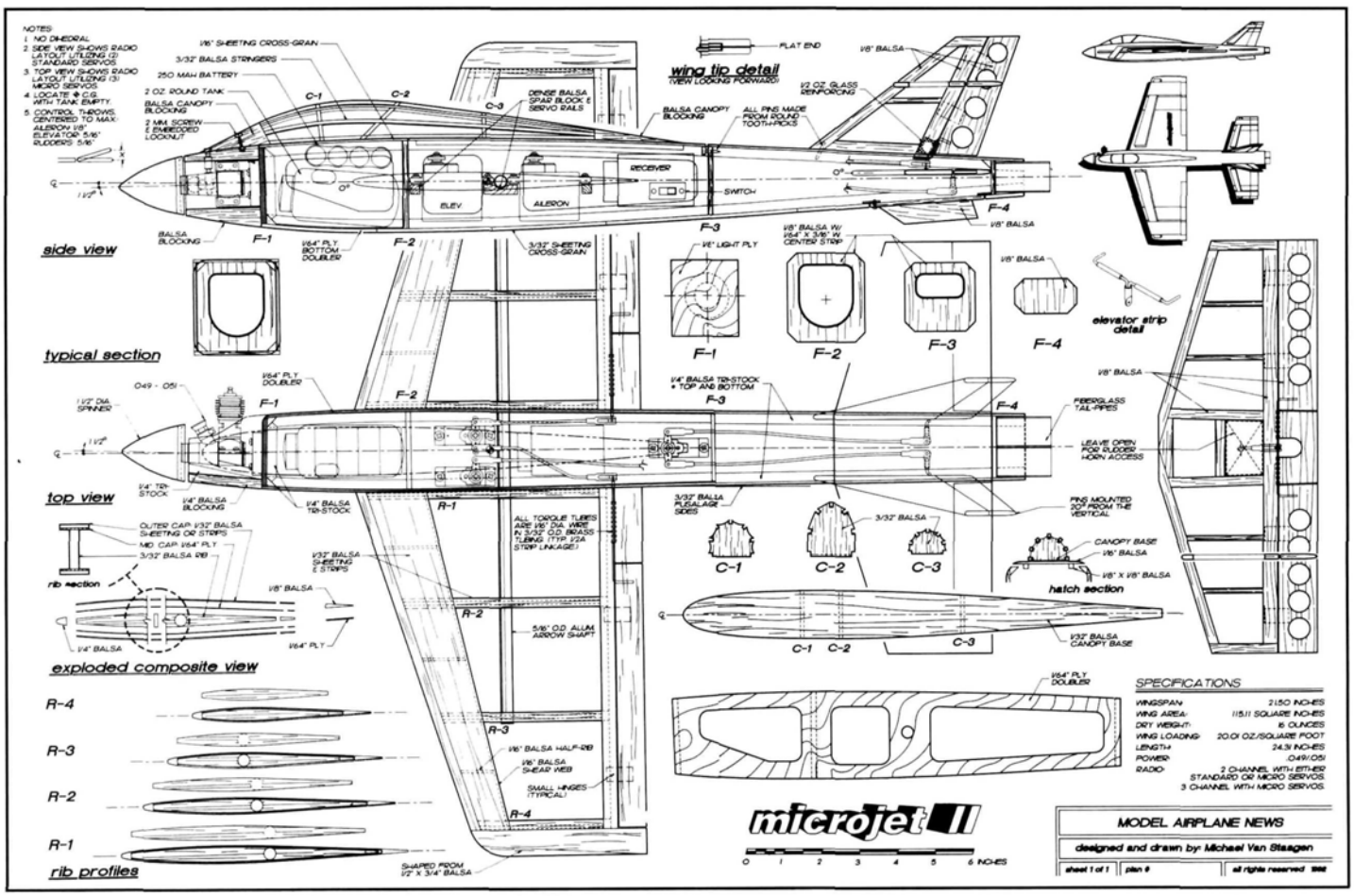


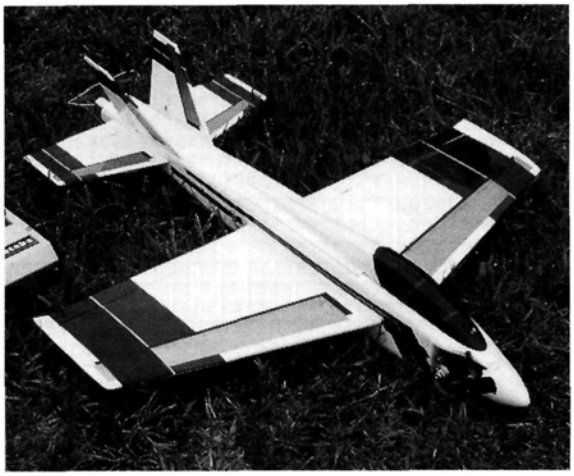
The framed-up Microjet II is ready for covering and the installation of the Cox .049 engine. This lightweight plane with its thin-airfoil design is capable of astonishing speeds.

to the TE, install the wingtip blocking, then sand the tips to shape. When shaping the LE, follow the plans; making a sharp leading edge will cause premature airflow separation when the wing reaches higher speeds. Shape the wing at R-1 to conform to the fuselage. Install the strip linkage and partial TE, then cut the holes for the arrow shaft. This can be done easily by sharpening the end of the shaft with a file and sawing 1/8-inch-deep notches into the end with a hacksaw. Hinging is done with small CA-type hinges that are cut in half lengthwise, and the torque tubes for the ailerons and rudders are made of Du-Bro* 1/2A strip aileron linkage.

FINS AND STAB

The Microjet II's tail feathers are made of 1/8-inch-thick balsa in various widths. I found it easier to simply strip what I needed out of 1/8-inch-thick sheet material. Although the plane flies well without rudders, you may want to add them for addi-





tional maneuverability; they're very effective and allow near knife-edge flight. If rudders are omitted, use a 1/8x3/8-inch TE, and extend the other balsa to meet it. The rudders and elevator are made of 1/8-inch-thick sheet, and the lightening holes are made using a 9/16-inch-diameter brass tube that has been sharpened and notched. The elevator linkage is made of 1/16-inch-diameter wire and brass tube similar to the aileron linkage. To join the two elevator-linkage halves, slide a small piece of brass tube over the two wires, pinch a flat spot at the end, and solder. Drill a hole in the flattened end for the clevis. Mount the linkage and partial TE. Round all the edges, and keep all of the LEs blunt. The fins are held in place by the extended tail post and one pin made out of a round toothpick.

FINAL ASSEMBLY

Slots must be cut in the fuselage to allow for the stab, and an additional notch must to be made to allow the linkage to pass into the fuse. Once the stab is square, cut the holes in the fuselage sides that will accommodate the aluminum wing spar. Additional slots for the aileron strip linkage are made in the fuselage side within the rib profile to allow the wing panel to slide completely on. Once the spar has been aligned, mount the balsa spar block on the inside of the fuselage. Remove the stab and the wing spar, fuelproof the nose, and apply covering to all components. For increased strength, the stab and wing panels should be covered with single pieces of material. In addition, warps and twists can be removed (or added!) by twisting the part and shrinking the covering. Install the stab and fins with CA, and secure the aluminum spar by gluing it only to the spar block. Make sure that the spar is centered and that it will reach slightly beyond R-3. Carefully align the wing panels to ensure proper incidence, and CA the rib edge of R-1 to the fuselage. No glue is necessary on the spar and the other ribs.

RADIO INSTALLATION

The servos are mounted on dense balsa rails and to the edges of the spar block. The pushrods are 2-56-type steel rods with threaded connections at one end and soldered connections at the other end. The receiver is wrapped with a thin layer of foam and held down with balsa scraps glued into place. In the 3-channel version, the aileron servo is mounted 1/4 inch higher for better horn clearance. Because of the small linkages, the control throws may be best controlled by using linear dual rates. In any case, do not exceed the recommended throws until you've flown the Microjet II a few times.

Building the Microjet II requires some degree of construction expertise, and it's probably best suited to advanced pilots particularly because of its small size and extremely fast flying speed. But if you build one, I'm sure that you'll have as much fun with your unique model airplane as I have had with mine.

**Addresses are listed alphabetically in the Index of Manufacturers on page 131.* ■

FIELD & BENCH REVIEW

A sport aerobatic model equipped with LE slots

I LIKE THINGS that are unusual; but if you were to see my current stable of aircraft, you might find that hard to believe. When I was asked whether I'd like to do a Field & Bench Review on a model that had wing slots, I got into the Eliminator project without hesitation. It seemed natural to add slots to an ordinary 3-channel trainer; and slots make this trainer a true short takeoff and landing (STOL) performer. The kit's manufacturer, High T.E.K. Models*, also sells slot material separately.

WHAT ARE SLOTS?

Glad you asked. Slots (often confused with slats) are auxiliary airfoils. Because they're placed on the wing just forward of the leading edge, they delay the separation of the airflow over the wing's upper surface, thus permitting a higher angle of attack before the wing stalls. Slots are fixed; slats are movable and retract into the wing's leading edge. These devices are common on jet airliners, and they've been used on smaller, military-observation aircraft.

CONSTRUCTION

The kit includes a large, rolled plan sheet, a 23-page instruction booklet, a materials list and other information. There's no hardware supplied with the kit.

HIGH T.E.K. MODELS

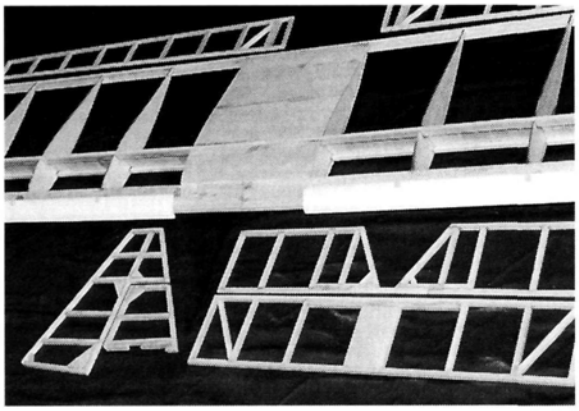
ELIMINATOR

by BOB GILBERT

• **Fuselage.** I found many things in the construction that were different from other kits, and I liked that a lot. The fuselage construction is unusual because the sides are made of 1/16-inch-thick sheet balsa. The two longerons that run down the outside of the fuselage add strength, and when they're covered, they help make the fuselage look more rounded.

The construction of the area near the firewall is a work of art. The firewall is tied into the landing-gear support block with 1/32-inch-thick plywood doublers on the fuselage sides, and gussets reinforce the landing-gear block and the doubler junction. Gussets on both sides of the firewall create a strong firewall/fuselage joint.

Ready for the first flight, Bob Gilbert (left) fires up the engine while fellow FLYRC member Dave Fitch assists.



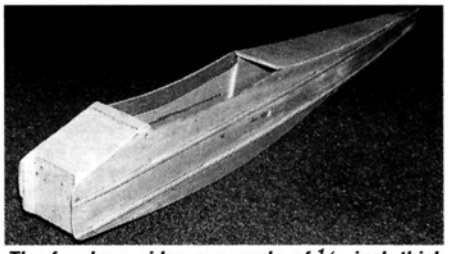
PHOTOS BY WALTER SIDAS AND BOB GILBERT

The completed wing, ailerons and tail parts. Notice the lightweight construction.

The fuselage has a huge interior, and you make a servo tray out of a piece of plywood that comes with the kit. Installing your servos high in the fuselage allows you to properly position the battery pack and receiver so you can achieve the correct balance point. I like this kind of flexibility in a design; I won't have to add weight later to achieve the proper balance.

Although it isn't indicated in the plans, I added a 1/16-inch-thick balsa sheeting to the fuselage top and bottom. It added a small amount of weight, but it also made the fuselage substantially stiffer. I added a 1/16-inch-thick, lite-ply plate under the tail, and I mounted a tail-wheel bracket on it. The rudder and elevator are made with stick construction and are light, simple and effective.

• **Wing.** The large, light wing has an unusual airfoil; there's a slight under-camber between the leading edge and the spruce spars. Considering its span, there are very few ribs. They're 3/32 inch thick, appear to be laser cut and all are identical in size and shape. No sheeting was shown for the center section, but I added 1/16-inch-thick balsa to the top and bottom of the first bay in each wing panel. The ailerons are built up with standard 1/4-inch-square balsa-stick construction and are a full span in length. I made the wingtip fences as shown, and I mounted them after I had covered the wing. I then turned my attention to the slots.



The fuselage sides are made of 1/16-inch-thick balsa sheet, and longerons are attached to the outside of the fuse for strength and stiffness.

• **Removable slots.** I put one 18-inch-long slot section on each wing panel. To assess the plane's performance both with and without slots, I made them removable by installing balsa blocks in the wing adjacent to two of the ribs in each wing panel. After fitting a spacer to the bottom of the slot, I taped the slot in place. I then drilled a hole for a 10-32 screw through the slot and the mounting block. I removed the slot and enlarged the hole in it to 3/16 inch. I hardened the holes with thin CA, left them to dry and then tapped them for a 10-32 thread. I treated them again with CA and tapped them again to form a clean, strong thread. I then used 1-inch-long 10-32 nylon screws to hold the slots in place.

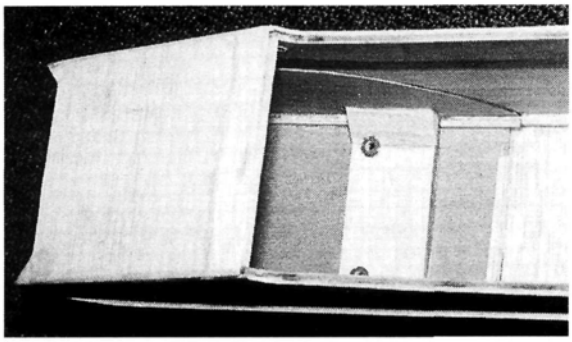
SPECIFICATIONS

Model name: Eliminator
Manufacturer: High T.E.K. Models
Type: sport aerobatic
List price: $63 (factory-direct only)
Wingspan: 56.25 in.
Wing area: 797 sq. in.
Weight: 4.25 lb.
Wing loading: 12.29 oz./sq. ft.
Length: 50 in.
Engine used: O.S. .40 FP
Prop used: APC* 11x4
No. of channels req'd: 4 (aileron, throttle, rudder and elevator)
Wing construction: balsa rib and spruce spar
Airfoil: symmetrical
Slot list price: $5 (small); $7 (large).

Comments: the High T.E.K. Eliminator is an unusual, great-flying model, and its fixed leading-edge slots make it unique. I made my slots removable to see whether they, in fact, improve model performance. They do! I don't recommend this model for the rank beginner, but if you've built a kit or two and are a sport pilot, the Eliminator will raise some eyebrows at the flying field. Its slow-speed flight performance is phenomenal!

Hits
- Lightweight.
- Unique construction techniques.
- Very good slow-speed light performance.

Misses
- No hardware included in kit.



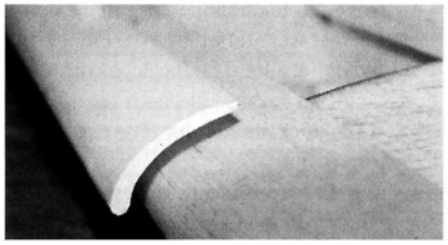
The firewall is tied into the landing-gear block with plywood doublers and triangular stock—very strong, light construction throughout.

FINAL ASSEMBLY

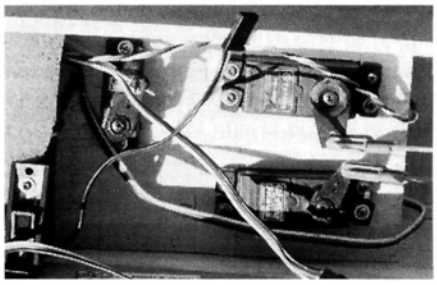
I covered the airplane with Coverite's* Black Baron white film and Aerospan* transparent blue and red film. The O.S.* .40 FP gets its fuel from a 6-ounce tank that's mounted in a foam box just behind the firewall. After completing the radio installation, which was easy because of the fuselage size, I installed the prop and weighed the model. I was pleased that it weighed only 4¼ pounds. That works out to a wing loading of only 12.29 ounces per square foot, which is in the glider range. I just couldn't wait to get it in the air.

AT THE FIELD

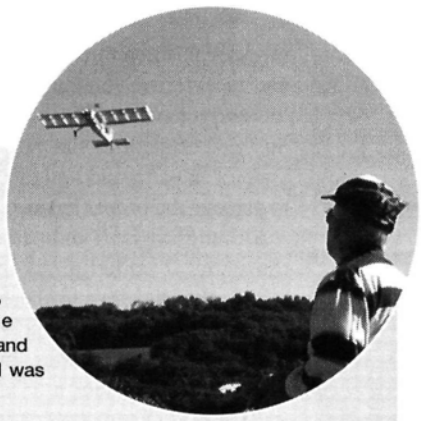
Before heading out to the field, I always check things such as balance, clevises and wheel-collar screws, and I give the plane a general going-over. For this particular plane, I wanted everything to be just right; I even checked the battery-pack charge one last time.



The slot material in the kit is factory-shaped and easy to install. I wanted to test the flight performance with and without the slots, so I mounted them with bolts to make them removable.



The fuselage has lots of room for the radio equipment. You can move your servos and batteries around to achieve the best balance and CG location.



It was a bright, sunny day with only a few clouds and some gusts of wind. I did the prudent thing and waited until later in the afternoon when the wind gusts had dropped to a reasonable level. The other fliers at the field had never seen a model with wing slots before, and they were eager to see how it would fly. They were disappointed when the first thing I did was remove the slots. Well, that was the plan!

After I had run up the engine and tested it by holding the nose in the air, I was ready for the first flight. I pointed the plane into the wind and eased the throttle forward. Even at a low power setting, it was in the air in only a few feet. As it flew away, I checked the trims. Only a couple of clicks, and I was up and away. It felt just great.

A FEW FINAL WORDS

The Eliminator is a great flier. It has seen lots of air time with me, and I've found it easy to fly. It shines in club fun flys, but the current rules of the National Competition Fun Fly Association don't include a class in which it can successfully compete. If you're looking for an unusual airplane with which to explore the limits of slow-speed flight without giving up aerobatic performance, the Eliminator is a good choice.

**Addresses are listed alphabetically in the Index of Manufacturers on page 131.* ■

FLIGHT PERFORMANCE

If a plane is to be used as a trainer aircraft, High T.E.K. Models recommends that you attach their slots in 18-inch-long sections on the wingtips with the slot's LE 7/16 inch in front of the wing's LE and about 1/8 inch above the wing's LE center line. For full STOL performance, full-span slots can also be added to the entire length of the wing.

• Takeoff and landing

The gear's wide stance and the steerable tail wheel make ground handling excellent. The plane gets airborne quickly, so not much rudder is needed to keep the takeoff roll straight. It just jumps into the air with almost no torque correction. (Adding the slots made the takeoff run even shorter.)

The airplane flies slowly, and landings are easy without the slots in place. Adding the slots makes landings even easier, as the plane continues to fly at even lower speeds. The enhanced airflow over the wing's upper surface allows a much higher angle of attack without developing a stall. The slots really work!

• High-speed performance

Because I was concerned that flutter could develop on the large ailerons, I hesitated to open the throttle fully. The 4-inch-pitch prop, however, maintained a reasonable speed, so I opened it up, and the plane flew well. Control was positive and crisp.

• Low-speed performance

With the low wing loading, the large control surfaces and the wing slots, the Eliminator really shines in low-speed performance. Even with 10 to 12mph winds, I could *almost* hover the model; with the slots installed, it was no problem at all, and the model was easy to control at zero ground speed! A lot of people were watching.

I flew the plane with a standard 4-channel radio. It was possible to land with an almost vertical descent. Because of the large ailerons, low-speed rolls were possible, but control response was slow. Loops were reasonably tight without coupling the elevators to the ailerons, but overall flight performance can be greatly enhanced with a computer radio. Low-speed performance in zero-wind conditions is phenomenal!

Because power-off glide is slow and controllable, normal landings are extremely easy. Adding a little power during a power-off approach, with the plane's nose up, can hang the model on its prop as it descends, for a high-angle, short approach.

• Aerobatics

Powered with an O.S. .40 FP, the Eliminator can climb almost vertically. A strong .45 would give you unlimited vertical performance, if that's what you're looking for. I was especially curious to see what effect the slots would have on inverted flight; it's possible with just a touch of down-elevator correction, and I didn't detect any change in inverted performance.

After a few failed attempts to enter a fully developed spin, I called the plane's designer, Tom Krapp. I wanted to find out if the problem was with me or the plane. Tom told me that with the slots in place, spins may not be possible; they're probably possible without the slots, but may still require a little more finesse than usual.

High T.E.K. recommends that the slot material you add to the wingtips for enhanced slow-speed performance on other models be shorter than what is used on the Eliminator. There should be a 1/16-inch space between the slot and the wing, and the slot should be moved farther forward so that its LE is about 1/8 inch below the wing's LE center line.

FIELD & BENCH REVIEW

A durable fun-fly ship for sport and competition

GLOBAL RICOCHET

by BILL GRIGGS & PETER COST

Author's note: a good friend is someone who helps out in your moment of need. When difficulties arose after the death of my father, Peter Cost stepped in to help me fulfill my obligations to the magazine. He is a veteran modeler (six years) who has good building and flying skills. He's also a good friend in every sense of the word. Peter framed up the wing of the Ricochet for me and provided some of the text for this article. The Ricochet was assembled as a cooperative effort, but to make it easier to follow, this article is written as if one person constructed the plane. Thanks, Pete.

Dave Baron (left), Roger Post and David Miles prepare the Ricochet for takeoff.

COMPETITION FUN-FLY planes have to be the closest things to telekinetically controlled planes in existence. This category of plane has the widest performance envelope I've ever seen, and you can do "stupid cool" things with them! I've seen people spin down hundreds of feet right to the ground, landing at the very last second with *zero* rollout. Want to perform a 10-foot-square loop? No problem!

The Ricochet, from Global Quality Kits*, is a fun-fly sport and competition model. It's a good compromise between the ultralight competition ships and rugged Sunday fliers. Its sheet-balsa tail surfaces make the Ricochet more robust than most stick-constructed ships, with only a slight penalty in weight.

THE KIT

The Ricochet's parts were packaged neatly and were well-protected from the possibility of shipping damage. I placed all the parts (not really very many in this simple kit) on a table and separated them according to building groups, i.e., tail feathers, fuselage, wing, ailerons.

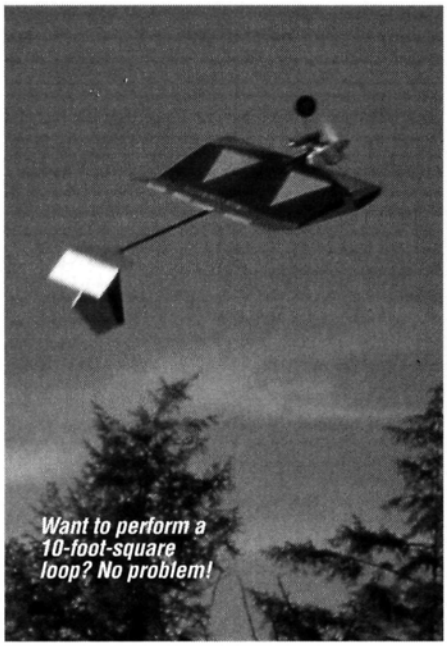
With all the parts identified, as instructed, I started to read through the directions. This proved to be valuable because of a comment at the end of the booklet on the center sections of the wing. (More on that later.)

The ply and balsa parts weren't cracked anywhere and were of a good quality, but the die-cutting could have been much better. Most of the cuts required the use of a razor knife, and considerable sanding was necessary to clean up the edges.

FUSELAGE

The "fuselage" was perhaps the most simple part of the construction—four, 1/8-inch-thick, die-cut plywood pieces laminated together with epoxy. I applied a very thin coat of epoxy to both sides of the parts, then I aligned the pieces and placed them in a clamp to dry. When the glue was dry, I removed the fuselage from the clamp and sanded the edges smooth.

The Magnum .36 engine (distributed by Hobby Shack*) was placed in the forward opening of the fuselage; then the mounting holes were marked and drilled for mounting blind nuts. The plans show the engine mounted on the rear of the opening, but if the engine is mounted in this position, the recommended 4-ounce fuel tank will not fit properly. I discovered this when it was too late to change. The engine should be mounted right at the front of the opening to provide more room for the fuel tank and help balance the plane with less nose weight. (More on this later.)



Want to perform a 10-foot-square loop? No problem!

PHOTOS BY WALTER SIDAS & BILL GRIGGS

Next, a hole for mounting the landing gear (made of a single piece of bent, 5/32-inch-diameter music wire) was drilled in the fuselage. The gear is held by two straps, but one was missing, so I replaced it with a strap I had on hand. I then removed the landing gear from the fuselage and painted the fuselage with Coverite's* 21st Century paint.

WING

The wing is the foundation of a fun-fly plane. Take the time to make sure that it's straight and true, and you will be rewarded with a good flying plane.

The plans and instructions do a good job of describing the assembly. Follow the directions step by step, and your wing will come out perfectly.

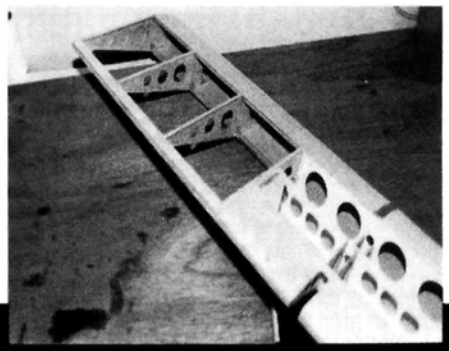
The wing is a fully symmetrical structure and has four spars and 10 ribs. The two center ribs require doublers for the center-section braces, which are made of die-cut plywood. The carbon-fiber tail boom and the radio gear are mounted on these braces.

I laid the forward spar over the plans (use wax paper to keep the glue off the plans) and pinned it into place. Then I placed the ribs down over the plans and squared up each one, but I didn't glue them. Next, I placed the upper spar in the notches of the ribs and dry-fitted the center sections to make sure the plans and parts had the correct proportions (they were perfect). I then glued the ribs to the forward spars.

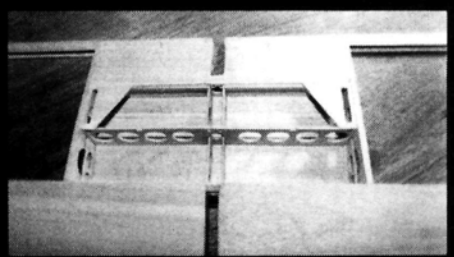
I pinned the rear spar into place and rolled the wing back over it. I double-checked the alignment then glued the ribs into place, followed by the upper spar. I can't stress enough the importance of keeping all the parts square with the plan when you roll the wing over the spars.

The center-section braces are mounted with the pushrod notches toward the top,

The parts for the Ricochet come neatly packed and protected for shipping. The full-size plans and well-detailed instructions simplify construction.



The Ricochet's wing consists of 10 ribs and four spars. The leading edge and center section are sheeted with 1/8-inch-thick balsa—a strong structure indeed!



The fully symmetrical wing's center section contains braces that support the carbon-fiber tail boom and hold the radio gear. Note the notches for pushrod clearance on the top of the center brace.

SPECIFICATIONS

Type: fun-fly sport/competition
Length: 40 in.
Weight: 2¾ to 3¼ lb.
Wingspan: 48 in.
Wing area: 780 sq. in.
Wing loading: 8.1 to 9.6 oz. per sq. ft.
Chord: 16.5 in.
Construction material: balsa, lite-ply and spruce
Power req'd: .25 to .36 2-stroke; .40 to .48 4-stroke
Prop used: 10x6
No. of channels req'd: 4 or 5
Control functions: ailerons, elevator, rudder, throttle, flaperons
Radio used: Futaba 7UHF Super Seven
Special servos: Futaba S-148
Assembly time: 6 hours to frame
List price: $64.95

Features: though not as light as an all-out competition fun-fly ship, the Ricochet is as durable as most trainers. The fuselage is made of four laminations of 1/8-inch-thick lite-ply. The wing is of typical balsa, spruce and lite-ply construction. The tail boom is made of fiberglass. Rolled 35x50-inch black-line plans and a 16-page manual with isometric drawings and check-off boxes are included.

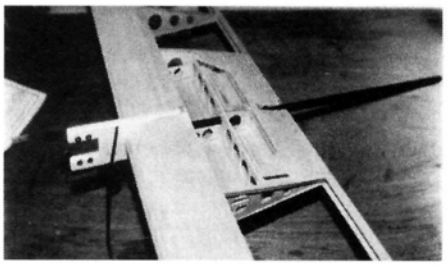
Hits
- Flying characteristics.
- Durability.
- Instructions.

Misses
- Fuel-tank fit.
- Die-cutting of wooden parts.

Modification I may try
- Making a built-up tail section to trim weight off the tail.

then the half ribs are put into place. Next, the ½-inch-square balsa leading-edge is positioned and glued into the notched ribs. I sheeted the wing's leading and trailing edges with the 1/16-inch-thick balsa (supplied with the kit) and cap-stripped the ribs. I trimmed the leading-edge sheeting to accept the fuselage and then did the same thing to the trailing edge to accept the tail boom.

I built the ailerons by first laminating the

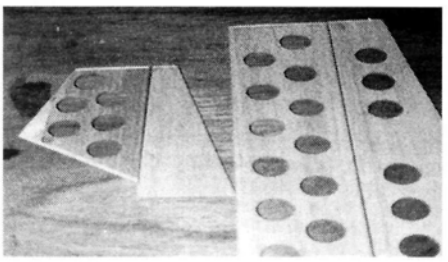


The fuselage is made of four, 1/8-inch-thick pieces of die-cut plywood that are laminated together with epoxy. This simple fuse and the carbon-fiber tail boom are both attached to the wing's center braces.

1/8-inch-thick balsa ribs together so that there were tip- and root-rib laminations for both ailerons. The two tip ribs were pinned into place over the 3/8 -inch-thick trailing edge, then the 3/16 -inch-square leading edge was glued into place. The rest of the aileron ribs were then glued in, along with the diagonal cross-braces. Last, the trailing-edge top sheeting and capstrips were glued on.

TAIL FEATHERS

The tail section is made of 3/16-inch-thick hard-balsa sheets that have die-cut holes for lightness. The most difficult part in this assembly step is punching out the die-cut pieces to leave holes. For stiffness, I laminated 1/8 x 3/16-inch balsa strips to the outer edges of the vertical and horizontal stabilizers.



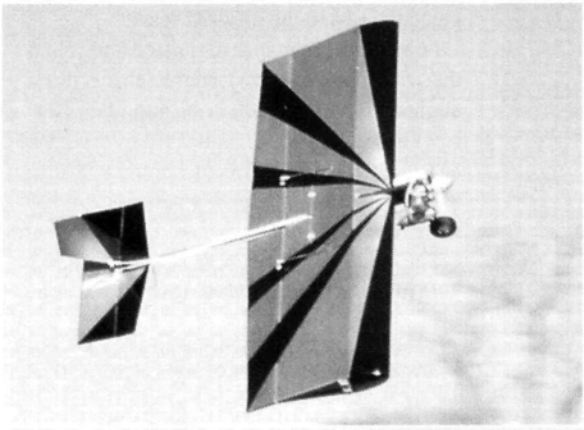
All the Ricochet's tail feathers are made of hard, 3/16-inch-thick, sheet balsa. Lightening holes have been die-cut into the pieces at the factory. For stiffness, the author added balsa strips to the outer edges of the horizontal and vertical stabilizers.

To sand the leading edges of the elevator and rudder to a 45-degree angle, I made a jig using scraps of 1/8-inch-thick ply (one 1x3-inch piece, one ½ x3-inch piece and one ½ -inch-square piece) and a piece of 100-grit sandpaper. I cut the ½-inch-square piece on the diagonal to make two small triangular pieces. Using these triangles as braces, I glued them to the remaining pieces to make a sanding block with a 90-degree opening. Running this block over the leading edge of the elevator and rudder left a perfect 45-degree angle on both sides of these parts and created a perfect center line.

After hinging the tail surfaces and testing their fit, the basic construction of the kit is

FLIGHT PERFORMANCE

by DAVID C. BARON



The Ricochet is designed to let you enjoy hyper-maneuverability. I may be creating a new word here to describe fun-fly-type aircraft, yet you don't have to care at all about ever entering a fun-fly to enjoy flying this type of plane. With practice, it can be hovered like a helicopter, flown backwards in any wind and made to perform loops that are scarcely larger than its length!

• Engine suggestions

The engine sizes recommended for this plane are fine as long as you know what to expect. With a .25 engine, vertical performance is more than possible. By going to bigger displacements, you gain acceleration. The point of putting a larger engine in these planes is never to fly faster; it is to *maneuver* faster. Once your maneuver is complete, throttle back.

• Taxiing

This plane would only taxi in a vacuum. When it moves and its airfoil bumps against air molecules, it starts to fly. Place it on the ground, facing into the wind, and enjoy.

• First-flight hints

The best way to test-fly this style of plane is to keep your throttle below 1/3 until the plane has been fully trimmed out. When a fun-fly plane is out of trim, at full throttle, you can expect a trip like that of a bucking bronco. It is much easier to deal with if you keep it slow!

• Landings

The Ricochet is a real pleasure to fly because it goes exactly where it is told to go, the instant that you tell it to go there. This is because of its oversize control surfaces and incredibly low wing loading. This is most evident during slow flight and landings. If it's moving, the Ricochet is flying. These types of design have excessive drag. When balanced by thrust, they fly with little apparent effort. When power is reduced, they set up slow-speed descents that are predictable and stable. When dead-stick, the descent is steeper and forward speed is slower. You will get only one flare if your engine is off. (Hey; when you've used up your air speed, you have to lower your nose to get it back.) In the case of the Ricochet, you need only a few feet of altitude to start flying again, and if you bump into the ground before that happens, there's probably nothing to worry about because it was going at less than 5mph!

• Slow flight

Because slow flight with this style of airplane is so slow, some of the complications of slow flight really stand out. If your plane refuses to turn in a coordinated manner at slow speeds, it's suffering from adverse yaw. The problem lies in the drag created by the ailerons when turning. The downward-deflected aileron will create much more drag than the upward deflected aileron. (This is because the plane is at a higher angle of attack.) The aileron that is down reaches a point at which it is creating more drag than lift. At this point, the plane turns the wrong way. Fortunately, the solution is simple: shift both ailerons up 3 to 5 degrees so that the neutral position now is deflected up into a reflex.

• Fast flight

The downside of any fun-fly plane is the very predictable outcome of flying too fast. If you insist on flying around like a pylon racer, your plane will self-destruct, regardless of which engine you use! This style of plane, with its oversize control surfaces, will flutter apart so fast that you might think it exploded in flight.

• Aerobatics

The Ricochet will do every trick in the book and quite a few that haven't yet been written down. I've found that the most spectacular maneuver is a flat spin without a recovery! What I mean by this is a spin in which the plane is descending so slowly (and is so tight and level) that you can let it go all the way to the ground! An instant before impact, you neutralize the controls so that the deflected control surfaces don't do double duty as landing gear. (This tends to strip servo gears.) Not only can you land it without damage, but the location of the nose wheel guarantees that the engine is still running! The hard part is in positioning the entry of the spin so that the plane comes down where you want it to. It also takes some careful practice and experimentation to arrive at the right combination of control-surface throws.

complete. I accomplished all this in about seven hours. I then final-sanded everything smooth and prepared to cover the plane.

COVERING

I decided to try Carl Goldberg Models* Ultracote film covering because I had heard good things about it but had never used it myself. Ultracote is unique because it can be ironed onto a structure and then heated and removed without being damaged. It isn't as glossy as some other coverings, but I feel it is a closer match to the sheen of a painted fuselage. Ultracote differs from other films in that the adhesive is separate from the pigment. This means that very little residue or bleed-through occurs when the film is heated and removed. This quality makes Ultracote a good trim material to apply over itself. I'm pleased with the results.

FINAL ASSEMBLY

Final assembly of the Ricochet goes very quickly. First, the fuselage is glued into the slot in the wing's leading edge using 5-minute epoxy, then the tail boom is epoxied into place.

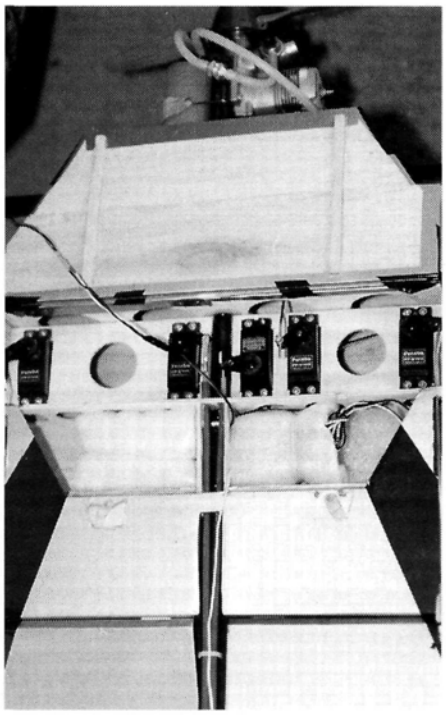
After the epoxy had cured, I clamped the wing to the workbench and blocked it up until everything was level. I spent time carefully aligning the horizontal stabilizer with the wing and then glued the stab to the tail boom. Then I used a triangle while gluing the vertical stab to the tail boom and horizontal stab.

I removed a patch of covering from the wingtips to mount the plywood wing-skid mounting plates. After I had mounted the plates, I bent the wingtip skids to shape and mounted them on the plates.

I re-installed the landing gear, added the tail skid and mounted the engine in the fuselage. Then I bent the fuel-tank mount and attempted to mount the tank. This is where I ran into trouble. The plans call for a Sullivan* R-4 4-ounce fuel tank while the instructions mention a Du-Bro* 4-ounce tank. The pick-up tubes for these tanks would protrude into the prop arc if the engine was mounted in the position shown on the plans. I studied the photo on the box of the Ricochet and noticed that the tank in the picture had the tube bent upward, out of the prop arc. I used this "fix" because I didn't want to buy a *third* fuel tank. This was my only major gripe with the kit, and I've been assured that the problem will be addressed in the next kit run.

INSTALLING THE RADIO

I used Sullivan flexible Gold-N-Rod pushrods for the elevator and rudder hookups. The pushrods are held tightly on the tail boom with plastic tie-wraps. These wraps prevent the tubes from flexing and make the setup tidy. The ailerons are driven with 1/16-inch-diameter pushrod wire.



Radio-gear installation is simple and straightforward. Sullivan's Gold-N-Rod pushrods control the large elevator and rudder.

The receiver is wrapped in foam rubber and mounted behind the servos in the radio bay. To reduce the amount of nose weight needed, the receiver battery is mounted forward between the aileron and rudder servos.

For initial flights, the manufacturer recommends control throws of 1½ to 2 inches for rudder, ½ inch for elevator and ¾ inch for ailerons. These throws can be increased as experience is gained, but they're good starting points. Try to get mechanically as close as possible to the manufacturer's recommended throws; then make fine adjustments with your computer radio. This will greatly simplify your radio programming chores.

The Ricochet could be flown with a standard radio, but the top of its performance envelope can only be reached with a radio that allows the mixing of several channels. I used a Futaba* Super Seven radio. Many of the advanced mixing functions needed by the Ricochet are programmed in at the factory.

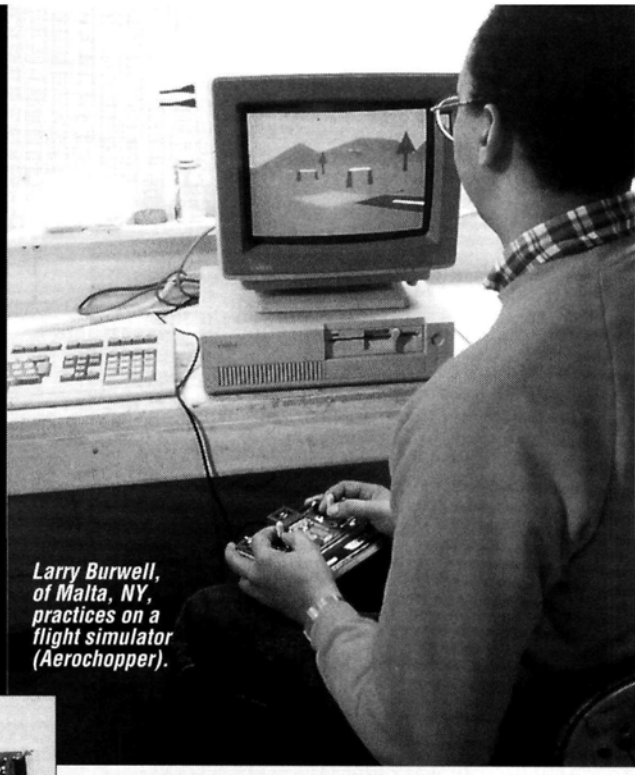
The Ricochet combines the wild "seat-of-the-pants" responsiveness of a competition fun-fly ship with the durability of a trainer. It isn't as light as most full-blown competition ships, but I think that the weight gain is justified by the increased durability. The Ricochet is a good ship to learn the ropes with while also being competitive. Add the kit's low cost to the equation, and you have a real winner.

**Addresses are listed alphabetically in the Index of Manufacturers on page 131.* ■

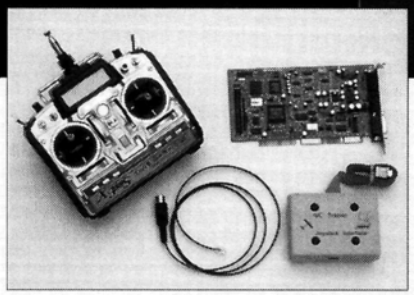
Survey of R/C Model Flight Simulators

by DAVE GARWOOD

Build experience on a sim before taking your first solo—an exclusive guide to popular programs



Larry Burwell, of Malta, NY, practices on a flight simulator (Aerochopper).



The Computer Designs R/C Trainer Joystick Interface allows you to use your own radio transmitter to control a simulator on an IBM computer. Also shown are the cable that connects the radio trainer cord plug with the Interface and a SoundBlaster sound card, which incorporates a joystick port.

FLIGHT SIMULATORS have been used to train pilots of full-scale aircraft since the 1950s. These days, airlines use simulators for 100 percent of the training when preparing an experienced pilot to fly in a new aircraft type; FAA check rides are given in simulators. For at least 10 years, personal computer (PC) versions of flight simulators have been available to train R/C model pilots.

This article presents a survey of PC-based flight simulators for R/C pilots—three from the U.S. and two from the U.K. In case you haven't used one before, I include a brief description of how the programs work. Beyond the description, I try to answer the two most often asked questions: can I learn to fly R/C on a simulator, and are they worth their cost?

GENERAL SIMULATOR DESCRIPTION

The heart of an R/C flight simulator is the computer program that presents the simulated aircraft on the screen. The program controls the look of the model, the feel of the interactions between the control box and the aircraft, and user setable variables such as roll rate and wind conditions. Some programs concentrate solely on an accurate depiction of an R/C helicopter, while others simulate helicopters, fuel- and electric-powered airplanes, ducted-fan jets, thermal sailplanes and even rocket-launched gliders. All of the simulators allow the customization of multiple parameters to adjust the performance of the simulated aircraft to match the one you're learning to fly. Some of these "sims" allow you to adjust as many as 100 variables in the aircraft and environmental variables such as wind, sun angle and cloud cover.

The variety of control boxes (transmitters) includes:

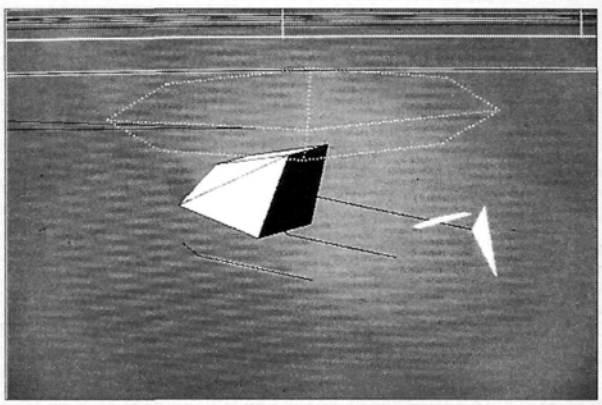
- specially made control boxes;
- "real" R/C transmitter cases modified for simulator use;
- a pair of game joysticks;
- an interface device for using your own radio transmitter if it's equipped with a trainer cord or DSC cable.

The variety of interfaces between the transmitter and your computer include:

- specially adapted game cards;
- standard game cards, including sound cards with game ports;
- standard serial or parallel ports.

All four transmitter types work well, but your preferences may lead you to one type or another, perhaps based on your own radio or your preferred location of trim tabs. All three interface methods work well, but your particular computer setup may dictate that one is more suitable than another; for instance, you may not have a serial port that's free.

Generally, the simulators are shipped with clear installation instructions, but if you run into problems, technical support is available from the program makers. Information on difficult installations and customization of specific airplanes is



A CSM simulator R/C helicopter close in.

Larry Burwell hovers his X-Cell 60 after learning the maneuver on a flight simulator (Aerochopper).

PHOTOS BY DAVE GARWOOD

exchanged in on-line discussion bases such as CompuServe ModelNet and the Internet Newsgroup rec.models.rc.

Once the transmitter box has been connected and the program is running, you "fly" an airplane on the screen by controlling ailerons, elevator, rudder and throttle, or "fly" a helicopter on the screen by controlling cyclic roll, cyclic fore/aft, tail rotor and collective pitch. Some simulators produce realistic sound using a sound card, and others use the limited PC speaker. Everybody I've seen using a PC simulator does feel as if he's flying an R/C plane or helicopter when using a sim, and discussion quickly turns to modifying flight parameters to make the model higher or lower in performance and stability, depending on the flight experience of the R/C pilot.

The most serious limitation of a PC simulator is the lack of peripheral vision to see your surroundings, while the greatest contribution of a PC simulator is the "no-pain

A Dave Brown Products RCFS-4 low-wing sport plane on a low inverted pass.

crash." When you experience a simulated crash, you simply reset the model on the runway or pad and re-launch it.

CAN YOU LEARN TO FLY FROM A SIMULATOR?

Well, no and yes. Simulator publishers and experienced R/C pilots agree that it would be extremely tough, if not impossible, to learn R/C flying from a computer simulator alone. When first learning to fly full-scale aircraft, trainees are exposed to both simulators as well as hands-on time with a real airplane and a live instructor. So it is with R/C flying, but those who have used R/C simulators see them as terrific help in climbing the R/C learning curve.

"The simulator was very valuable for my 11-year-old son who was used to the Sega/Nintendo games and controllers that do not require a soft touch. He was able to work on items that the instructor talked about in our real lesson without the fear of crashing. Both of us are still flying our original planes, and I attribute that to both a good instructor and the extra practice we obtained from the simulator. I would caution not to use the simulator as a substitute for an instructor but as a complement to a good instructor."

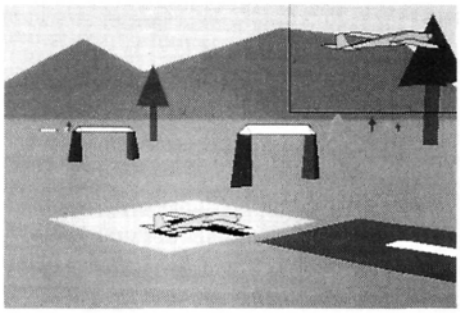
—Doyle Souders; Internet: doyles9999@aol.com

Program name	**CSM Simulator** ver. 3.04	**R/C Aerochopper** ver. 1.02 (version 2.0 due out 2/95)	**R/C Flight Simulator** Release 4
Aircraft type(s) simulated	Any single-rotor model helicopter	Model airplane, helicopter, glider, ducted-fan jet.	High-wing and low-wing airplanes; electric and rocket gliders, ducted fan, biplane, helicopter.
Computer required	IBM 386SX 25mHz (co-processor rec.) Will run at 32 FPS on 486DX2 and Pentium PCs	1. IBM 286 12mHz minimum (386 recommended). 2. Atari 520 ST. 3. Commodore Amiga 500. 4. Macintosh SE/+/Classic, System 6 only.	IBM 286 or faster processor; EGA or better color. Will support SoundBlaster sound cards and 100% compatibles; otherwise, no sound.
Input device	1. Two analog joysticks into standard game port, or 2. MDS controller into standard game port, or 3. MDS controller into MDS serial interface.	Comes with Futaba Conquest modified for computer use, which plugs into serial port. (no game card needed) Includes adapter for 9-pin or 25-pin serial port.	1. Dave Brown Products simulated transmitter with trim and dual-rate switches on the Joybox, or 2. two joysticks plugged into a Y-harness, or 3. Computer Designs R/C trainer interface for your own radio transmitter (all three need a game card)
Major program features	Aerodynamically accurate real-time simulation. Geometrically accurate high-speed 3-D color graphics (optimized for display speed and accuracy, not video-game appeal). Three idle-up states with own pitch and throttle curves. Over 70 adjustable parameters, including weight, boom length, yaw inertia, stability, cyclic response, tank capacity. Switchable gyro gain, ATS, tail trim and throw rates. Suitable for beginners, but primarily intended for serious aerobatics pilots.	Presents four types of aircraft models with very realistic flight characteristics, smooth motion and fast response. There are over 140 adjustable parameters, including those for helicopters, airplanes and wind. Distribution disk contains 11 helicopter parameter sets and 11 airplane parameter sets. The simulated glider can be launched on winch or with power-pod assist. Four-camera-movement control modes display view of R/C aircraft as if taken by imaginary camera.	Accurately simulates R/C aircraft and helicopters in a real-life environment. Choose from 20 pre-programmed models (10 airplane, 10 helicopter) and fly them as is, or change them to fly slightly or completely differently. The user sees models, runways, scenery from ground view; distance, speed, dual rate visible on screen; functional pylon course, limbo pole "ILS" landing aid. Helicopters have adjustable pitch curves, switched or switchless inverted capability and autorotation.
Special program features	Pre-programmed with many popular helis (Concept 30, Kalt Alpha 2, etc.). Has been successfully used to predict performance of prototype models. Real unit approach (e.g., pitch specified in degrees) teaches model setup technique. Helicopter analysis program included.	The program is written 100% in Assembly language for fast smooth graphics, it's supported on four computer platforms, and the transmitter has built-in 8-bit A-D converter, so no game card is required. Several copies bought by U.S. Navy Unmanned Air Vehicle Program Office.	ANALYZE program allows the user to program own plane or a future plane and fly it in the simulator. All skills and techniques learned in the RCFS-4 may be transferred to real-world flying—no need to adjust from non-realistic controls or features. Joybox works on other flight sims and games.
Technical support	Phone and fax from 9:30 a.m. to 9 p.m. GMT (5 hours ahead of EST), 7 days. Full support given to hardware, software and modeling terms.	Telephone support	Telephone and fax support 8:30 a.m. to 5 p.m. EST weekdays.
Price	Software—£30 Optional MDS controller—£62 Optional MDS interface—£28	Program with Futaba transmitter—$200	Software —$79.95 Software and Joybox controller—$169.95
Order from:	Dr. C.S. Mill (CSM) 8 Littlebrook Close Hadfield, Hyde, Cheshire England, UK, SK14 8AW; phone/fax: (44) 0457 854680.	Ambrosia Microcomputer Products, Inc. Ste. 371 98 West 63rd St. Willowbrook IL 60514; (708) 655-0610.	Dave Brown Products 4560 Layhigh Rd. Hamilton OH 45013; (513) 738-1576; fax (513) 738-0152.

There are specific areas in which simulator training is a boon. For instance, one of the great hazards in R/C pilot training is control reversal when an airplane is flying toward the pilot, or when the helicopter is flying nose in. A "dumb thumbs" mistake here almost always results in a crash, and simulator practice can teach this skill without damaging a model.

"While I agree that a sim isn't necessary, in my opinion, it almost guarantees that a beginner will be successful. Most devastating crashes happen when a pilot loses orientation, such as when the model is coming toward him. These 'smokin' hole' type crashes discourage beginners. This type of orientation practice can be done over and over again on a simulator, with brain freezes and all, without the loss of a model. Plus, during the winter, it keeps the cobwebs away."

—Steve Boyer; Internet: 73474.1530@compuserve.com.



A mid-wing sport airplane in the start position in Aerochopper.

Some R/C pilots, me included, are self taught in the basics of R/C flight, but have received instruction in advanced maneuvers and aerobatics. To be successful under this regime, you have to be highly motivated, stubbornly persistent and immune to being put off by crashing and rebuilding. People in this situation stand to gain the most with an R/C sim because they can practice basic procedures on the computer and have a good idea of what the plane will do before they go to the flying field.

"We saw a guy hover a helicopter through a full tank on his first try today! We asked him how he learned so fast, and he said he had been using Dave Brown's sim and could even fly that inverted. We were thoroughly amazed that the guy was able to do it. I had seen before that the sims can help with planes, but to see that guy hover the heli on his first flight just amazed me beyond words! It made us all reconsider the R/C flight sims."

—James Prouty; Internet: proutyj@emh.kadena.af.mil

My friend Larry Burwell attempted to teach himself to fly an R/C helicopter each year for five years. His first crash cost him $80 in broken parts, and subsequent crashes cost even more. He tried a training stand, an X-shaped brace and a circular brace, but he was still unable to hover. Then, for about a

Program name	R/C Trainer—Joystick Interface	Tru-Flite / Century Helicopter Flight Simulator ver. 3	Skylark ver. 2.0
Aircraft type(s) simulated	None; this is special hardware	20 helicopters (incl. Ninja Pro, Jet Ranger) and 14 model airplanes (incl. Ultimate, Twin, fun fly)	R/C Helicopter (currently in process of adding other types)
Computer required	IBM-compatible running desired simulator program	IBM 386/25 or compatible	IBM 80386 or better, VGA video
Input device	This allows use of your radio as an input device for R/C simulators and full-scale flight-sim programs.	Full function, dual-stick, multi-mode transmitter	JR transmitter box, modified for computer use, now shipped with special interface card—soon to be user choice of serial or parallel port.
Major program features	Specialized hardware allows use of computer flight simulator using your existing R/C transmitter, as long as it has a trainer or buddy-box plug or a direct servo connect (DSC) cable. Simply plug supplied cable into trainer-cord plug and connect the unit to a standard joystick port or game port on an IBM-compatible computer. You'll have all mixing and dual-rate functions, and they'll be controlled normally on the transmitter, not on the keyboard. Supports standard and computer radios.	Easy to configure and realistic in performance. Helicopter idle-up, vee-curve, throttle hold, night flying. Adjustable roll rate, pitch rate, yaw rate. Adjustable camera angle, camera follow mode. Switchable from Mode I to Mode II and Mode III. Choice of flying sites, from basic heli pad to full airport scene. Sound-card support with Doppler effect; realistic engine and rotor sounds to further enhance the simulation. Window mode displays a duplicate model in a corner screen box to show attitude of model at a constant distance (useful when main model is flown far away from pilot). Flight record and playback—view from any angle, including judge's position. Playback may be in slow motion, either forward or reverse. Software updates are free; payment is asked only for shipping and additional instructions needed.	Highly realistic and easy-to-use real-time system. Flight equations are completely general and very realistic—no restrictions on flight attitudes or maneuvers. Adjustable flight parameters allow you to set up simulated helicopters to fly like any real one, R/C or full-size. True 3-D space to move around; position yourself at any point within the simulated scenery, including chase mode, and even sit in the helicopter. Six switches on transmitter box can be programmed to control frequently used functions. Beginners' mode for both normal and inverted flying adds adjustable degree of stability to the helicopter. Rotor disk can be shown as solid, translucent, or outlined. Save the helicopter's position, and restart from that position. Wind with adjustable speed, direction and gustiness.
Special program features	Works with any program using joystick inputs, such as combat-flight simulators and auto race programs, or drawing programs.	Connect to printer port; no need for separate game card. All parameter adjustments are done from transmitter rather than keyboard.	Easy-to-use pop-up menu system. Instruments can be displayed to show altitude, air speed, direction. Freeze helicopter's position (but not attitude) and practice nose-in or inverted hovering.
Technical support	Phone or CompuServe 72050,351	Telephone calls in UK or USA. In USA, ask for Shawn or Pete.	Telephone support weekday afternoons and evenings.
Price	$79.95 (plus $3.75 S&H in USA)	£179.95 UK; $224.95 USA.	$265 U.S.
Order from:	Computer Designs, 8530 N Montana Ave., Helena, MT 59601; (406) 458-9416; fax (406) 458-8625.	Century Helicopter Products, 521 Sinclair Frontage Rd. Malmesbury, Wiltshire SN16 9UH England, GB; phone/fax 0666 677452. Tru-Flite Technology, P.O. Box 1055 Milpitas, CA 95035; (408) 942-9525.	Digital WonderWorks, P.O. Box 3118, Ann Arbor, MI 48106; (313) 662-5275.

month, Larry practiced twice a day on the Skylark simulator, accumulating an estimated 20 hours of simulated stick time. On his first day in his sixth year of trying, Larry flew out two tanks of fuel hovering with his Miniature Aircraft* X-Cell 60. I photographed him a day later when he flew out a third tank with plenty of hovering and no crashes.

In another instance, Mark Lipsky had been flying R/C helicopters for about a year and had gotten comfortable with forward flight, but he was having trouble progressing beyond that. He wanted to learn aerobatics, but he hated to rebuild the chopper after a crash. He bought R/C Aerochopper, and within a month, he mastered nose-in hovering and got comfortable with loops and rolls. A little later, he learned to fly switchless inverted, and he transferred all these skills the real R/C ship with "no surprises."

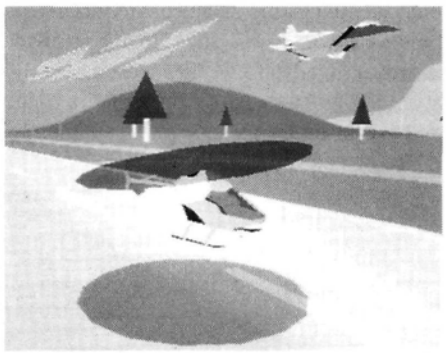
ARE FLIGHT SIMS COST-EFFECTIVE?

I think the answer is clear for beginning R/C pilots. The opinion most commonly expressed is: if a sim saves you from one or more crashes that would have cost you the price of the program, then you have saved money by buying it. My experience is that the R/C sims do, in fact, help you to avoid crashing and, thus, are worth their cost.

"While these programs are not the be all and end all of simulators, in a hobby where simple eye/hand-coordination mistakes can easily cost you $100, I think a simulator is a good value." —Doyle Souders

For experienced pilots, the answer is not as clear, but a sim still yields a positive cost/benefit ratio. I use one to practice low inverted passes and smooth out my Cuban-8s, because both maneuvers can be airplane eaters in the event of a brain cramp. R/C fliers with substantial time and money invested may have an easier time deciding to buy a simulator because they know they will be in the hobby for a while. Thought of as a long-term investment and with inexpensive software upgrades available for registered users, I believe the R/C sim is a good investment for accomplished pilots as well.

"I once crashed an R/C airplane trying to do a slow roll. I have since used the sim to perfect the slow roll and found that I can easily get cross control, top rudder and disorientation all worked through on the sim. My Ace R/C Bingo has stayed in one piece all season because of it! The sim is definitely not just for beginners, but it may be most valuable early on."* —Steve Boyer



The next release of Skylark will simulate R/C fixed-wing aircraft, and allow the simulation of "traffic" at the flying field. A ducted-fan F-15 Eagle is shown here in flyby.

THE FUTURE OF R/C FLIGHT SIMS

Software development is an iterative process: programmers listen intently to the requests of users and incorporate improvements into subsequent versions. With each new version, the programs have been getting better, and they'll continue to do so. If R/C flight simulation continues to follow the path of full-scale simulation, they will become so realistic that crashes will tend to occur on the computer only.

As more R/C fliers buy and use R/C sim programs, the market will expand. More programs will become available, and prices will fall as a result of increased competition. Hobby shops will stock one or more sim programs and will have them running in the store so that a prospective buyer can compare programs and pick the one most suited to his needs.

Hobby shops of the future will have R/C simulators running so you'll be able to "try before you buy" and make a better match between your skill and the performance of your next kit or pre-built airplane. *That* will help you decide whether you're ready to handle the P-38 Lightning with one engine out, ready to buy an F-18 Hornet ducted-fan jet or maybe get an advanced trainer instead.

Magazine kit reviews of the future may include computer-simulator settings to expand the description of flight characteristics of the airplane under review. Readers would then have a much more accurate description of how the plane flies than can be conveyed just by words and pictures alone.

CONCLUSION

This article is the third in a series of how aeromodelers use computers to advance their hobby activities (the others are in the November 1994 and January 1995 issues of *Model Airplane News*). Reader reaction to computer topics will determine whether more computerized modeling material is presented in these pages. The *Model Airplane News* staff and I are interested in your reaction to computer coverage and would like to know which types of coverage you'd like to see in future issues.

Please favor us by sharing your thoughts. Contact executive editor Frank Masi at 251 Danbury Rd., Wilton, CT 06854; fax (203) 762-9803; Internet: frankm@airage.com; or Dave Garwood at Internet: 70254.361@compuserve.com.

**Addresses not given in the accompanying chart are listed alphabetically in the Index of Manufacturers on page 131.* ■

A scale model is only as good as its finish and markings. Duplicating scale-aircraft markings is easy with Aeroloft Design's dry transfers.

HOW TO

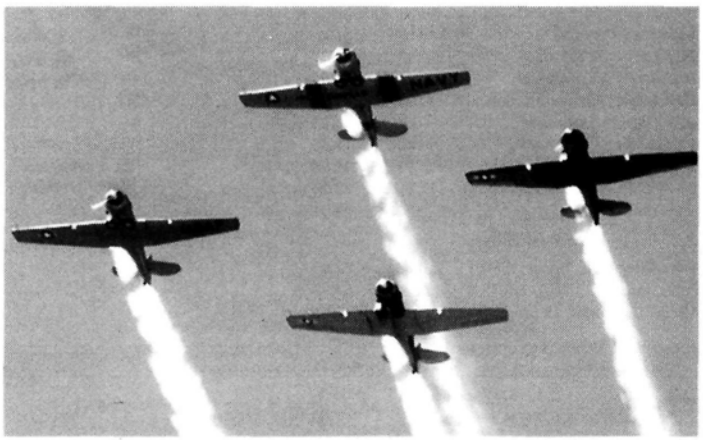
Duplicate Scale Aircraft Markings

by GERRY YARRISH

Using Aeroloft Design's dry transfers

THE saying "Beauty is only skin deep" holds true in scale modeling. To static judges, an average-built model that has a superior paint job and finish is more desirable than a perfectly built model that has a poor finish. What's up front is what counts.

Making the job of duplicating scale aircraft markings and lettering easier for the scale modeler is a company called Aeroloft Design*. This article shows you how they do it and how easy it will be to achieve beautiful scale markings on your next model.



The full-size SNJ Texan that I used as my subject was once the lead aircraft for the Six of Diamonds aerobatic show team. After a few letters and phone calls, its owner, Dr. Joe Scognia, allowed me to examine the aircraft in minute detail.

DOCUMENTATION

Unless yours is a sport-scale model—for which you can use off-the-shelf markings—you'll have to do some homework. Having the full-size aircraft available for measurements and photographs is the best situation. But even then, you'll need to keep track of your work to achieve accurate duplication in model form. You must know your subject in detail if you want a truly scale model when you've finished.

DOIN' IT RIGHT

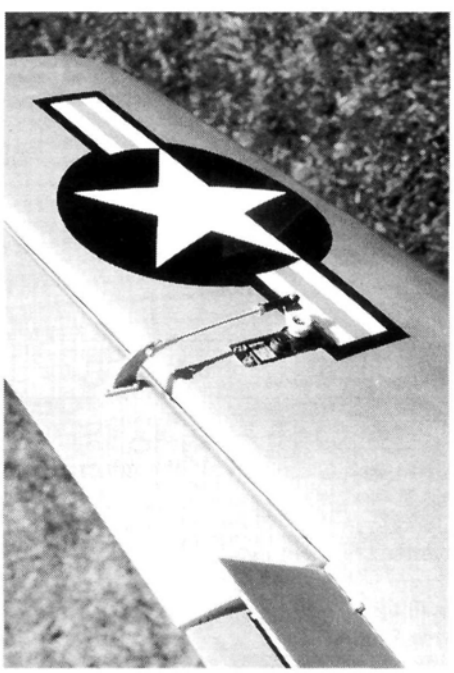
Go to an airport, a museum, or an air show to find your subject aircraft. Find out who owns it, and write or call for permission to photograph it at the owner's convenience. Some owners are more than happy to help out, and you'll gain the most information from the person who knows the aircraft best (and, possibly, make a new friend). Be aware, though, that some owners are not interested in helping a stranger who is asking questions about their plane. If this is the case, pick another aircraft to model.

Take along a notebook, a sketch pad, copies of three-view drawings of the subject aircraft and a good camera with lots of film. I use a Nikon 5005 with two lenses—a 70 to 210mm zoom and a 28 to 85mm lens. Agfa 35mm 100 ASA color-print film works well, and I always wait for a super-bright sunlit day to photograph. I also vary the exposure and shutter-speed settings to ensure that at least some prints will be good enough to use in my documentation package.

PLAN OF ATTACK

Start with basic overall views of the full-size plane, and photograph its left, right, front and rear. Then take quarter shots such as ¼ front, ¾ rear left and right, etc.

Next, move closer and photograph all large insignias, nose numbers, squadron markings, etc. Try to photograph these straight on to minimize distortion, and avoid using full flash. Continue to move closer to the aircraft, and photograph all the markings—from tail numbers to nomenclature markings such as "Step Here," "No Step," "Handhold," etc. If



One of the largest markings is the Star and Bars insignia, and even this is easy to apply. The wing and the fuselage insignias are the same size.

On the wing, "070" and "Jacksonville" again dominate. During the late '40s and early '50s, to discourage pilots from buzzing public areas, the military required that planes have unmistakable aircraft identification markings .

Go Navy! The Aeroloft markings are so thin that even fine panel lines show right through. Rivet details and hatch lines readily show where the markings have been applied.

you're replicating a military aircraft, you'll be amazed at how much lettering there is on the plane.

MEASUREMENTS

Photos alone are not enough to ensure the accurate execution of your model's finish. The next, and most important, step is to *accurately* measure the size and position of *every* stencil, marking and number you see, and record the figures so that you'll be able to refer to them back at the shop. This is also a requirement for having your markings duplicated and manufactured by Aeroloft Design; your markings will only be as accurate as the information you give to Aeroloft.

STANDARD FIGURES

Almost every U.S. military aircraft will be painted and marked according to military tech orders, and only aircraft and unit markings will vary. For example, all letters and numbers, regardless of size, will be in military-block style. The small nomenclature markings are usually applied with stencils and vary only in size. Nose art and personal insignias are the only non-standardized markings on the aircraft.

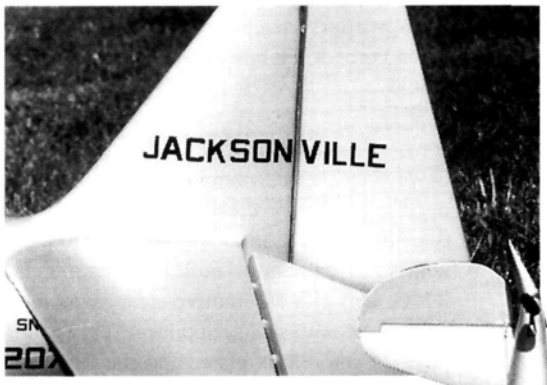
Start with the largest markings—i.e., Star and Bars insignias—and work your way down to the smallest "Ground Here" stencil. To make the process simpler, measure only the length of the insignia (bar end to bar end) and only the height of the letters. Write down all the measurements for the markings, and group the information according to style, size and color.

Document the positions of all these markings in your notebook using a common reference point; i.e., do not measure from marking to marking; rather, measure all marking positions from a fixed point on the airframe, such as the aft edge of the engine cowl or the rudder's hinge line. Record these measurements on sketches or on copies of your three-view drawings. Make large blow-up sketches of the really detailed areas (small measurements) so that, when you've finished, you won't have to go back and re-measure.

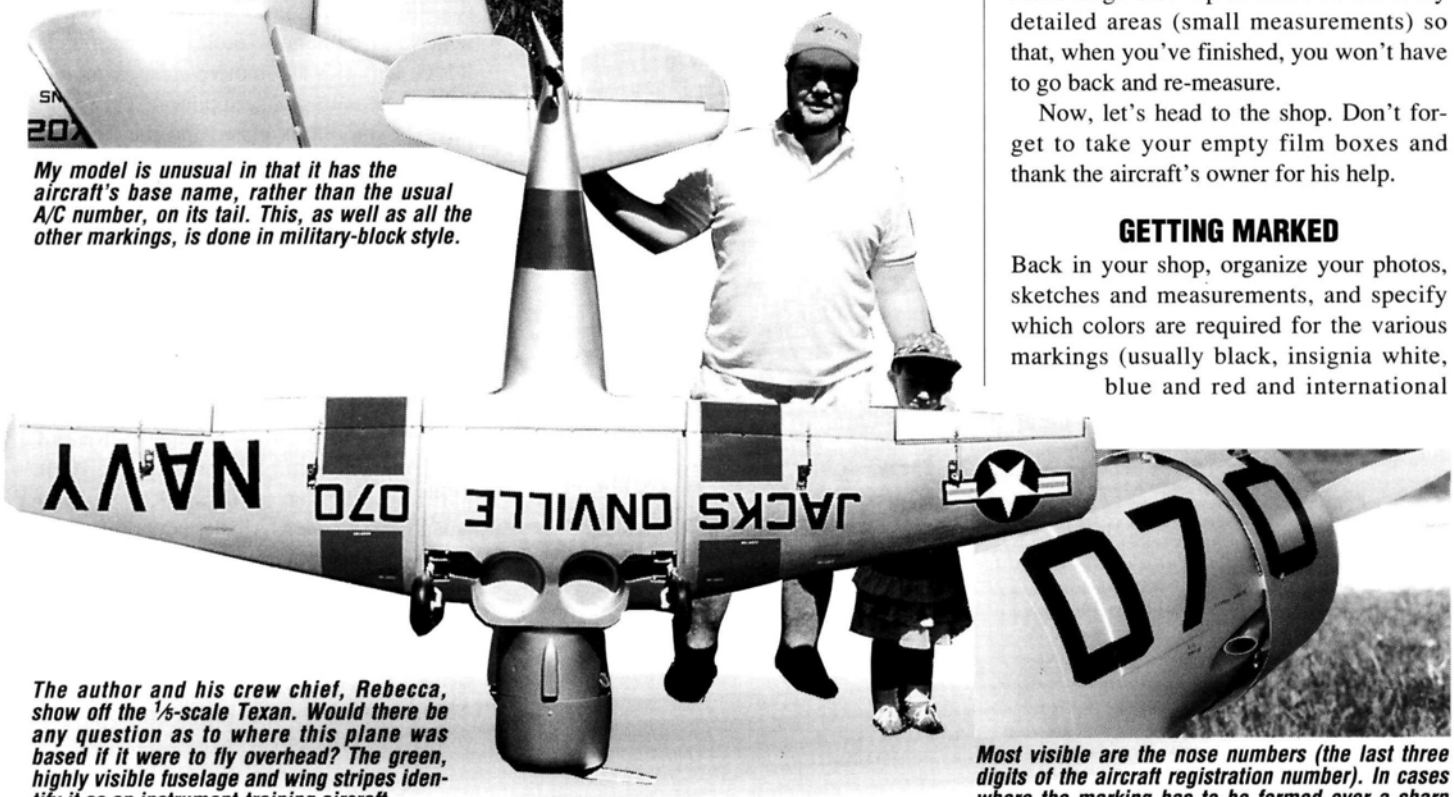
Now, let's head to the shop. Don't forget to take your empty film boxes and thank the aircraft's owner for his help.

GETTING MARKED

Back in your shop, organize your photos, sketches and measurements, and specify which colors are required for the various markings (usually black, insignia white, blue and red and international



My model is unusual in that it has the aircraft's base name, rather than the usual A/C number, on its tail. This, as well as all the other markings, is done in military-block style.



The author and his crew chief, Rebecca, show off the 1/8-scale Texan. Would there be any question as to where this plane was based if it were to fly overhead? The green, highly visible fuselage and wing stripes identify it as an instrument-training aircraft.

Most visible are the nose numbers (the last three digits of the aircraft registration number). In cases where the marking has to be formed over a sharp edge (the 0 to the left), to prevent it from wrinkling, you can cut the marking at the break line.

yellow.) Include your model's scale size, and send your package off to Aeroloft Design.

Aeroloft's graphics are the thinnest I've ever used, and they're made exactly to order. They're so thin because they're manufactured with alcohol-based inks rather than paint. Aeroloft duplicates all their markings in a process that involves separate color plates (negatives shot with a camera) for each color of the original artwork. Ultraviolet light is then used to set each separated color before the next color is applied. All the work is done by hand, and the quality and durability of the markings are excellent.

You receive the markings on a carrier sheet, and they're protected with a cover sheet so they're very easy to store, position and apply. The markings may be transferred very easily if the room temperature is at or above 70 degrees Fahrenheit. At lower temperatures, the adhesive will have to be pressed down a little harder for it to be released. I've used markings after storing them for six months and had no problems. Steve Slachta of Aeroloft recommends that you apply them as soon as possible, but if you do store them, keep them upright (they come in a slim cardboard box) and in a cool area.

Here, an Aeroloft marking is being rubbed into place. Tape it into position and then start to burnish it at the center and work out to the edges.

The closer you get, the more you see. Here's a good example of the stenciled markings that are common on military aircraft.

APPLICATION

Before you apply the markings, you should have a smooth, beautifully applied finish on your model. I spray on Hobby Poxy* two-part paints with an automotive-quality air gun. This very durable paint is easy to apply, and it makes a perfect surface for dry-transfer markings.

Start by measuring and marking the positions for your markings (draw a light pencil line or mark). Cut each marking out of its parent carrier sheet so that it will be easier to manage, and then position it on your model. When you're satisfied that it's positioned correctly, tape it down, then lift one side (keeping the other side taped in position), remove the backing paper, and press the marking into place. Slowly and carefully burnish the marking (I use a plastic propeller), working from the center toward the edges. You'll see that the color of the marking has changed when it has been properly transferred to the model. Once you get the hang of it, this goes very quickly.

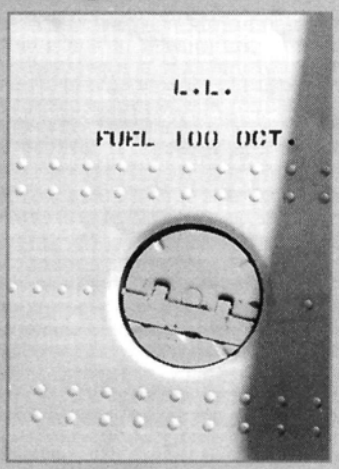
CLEARING OUT

Once they've been applied, the markings need a protective clear coat to seal them (they aren't fuel- or dope-proof) and to prevent scuff damage. Aeroloft recommends P.P.G. Ditzler's automotive clear (available from most auto-paint suppliers). This paint dries as smooth as glass, and the finished model looks wonderful. Flattening agent can be added to the clear coat to obtain the desired degree of sheen or flatness. Let your model dry in a dust-free area for a couple of days, and avoid the temptation to test the finish with your fingers.

That's it; from documentation to markings application, the process is easy if you organize your work. Best of all, if you ever decide to build another model with the same markings, a phone call to Aeroloft will have another set of markings off to you in short order. All their markings are stored in a computer and can be duplicated quickly—even in different scale sizes. Aeroloft also offers many "generic" marking sheets including common lettering, stencils, rivets, panels and panel lines. Try Aeroloft markings for your next project; you'll love the results.

* *Addresses are listed alphabetically in the Index of Manufacturers on page 131.* ■

Photos of full-scale subject.



The markings on the full-size SNJ. From fuel grade to the pilot's name, to where it's safe to walk, a military aircraft is covered with warnings and identifications. Reproduced for your model, these markings turn a great model into a truly scale reproduction. Aeroloft Design makes it easier than you think. Those who wish to get photo documentation of my Jacksonville "070" SNJ should call Bob Banka's Scale Model Research*.

SPORTY SCALE

FRANK TIANO

FUN SCALE AND NEW PRODUCTS

ONE OF THE very nicest things about scale modeling is its great number of subdivisions in which one can excel. Within the R/C division, for example, we have electric scale, schoolyard scale, profile scale, stand-off scale, squint scale, professional scale, ¼ scale and fun scale. Regardless of the category they fly in, scale modelers have one thing in common: they just love to build and fly a model airplane that resembles a real airplane. And if you think about it, where pattern and sport models were the hit maybe 10 years ago, almost any new-model release is one that at least resembles a full-scale counterpart; and that makes scale modelers happy for lots of reasons. Possibly one of the most important is that it's now our turn to have a large selection to choose from. Years ago, there were a kabillion sport and pattern kits introduced each year at several different trade shows, but now the worm has turned in a different direction—ours! What's all this leading to? The answer can be said in two words: fun scale!

What can you expect at Top Gun? Lots of beautifully done models, great weather and plenty of manufacturers. Here's a peek at Colonel Art Johnson's newest bird—a 102-inch F-82 Twin Mustang powered by a pair of O.S. 1.08s. Art uses 16x6 props to fly the 31-pounder, and the one-engine performance is unusually good.

Our pal George Gustafson finally pleased his Finnish friends by flying his new Bates Bearcat and taking two first places in the first two events he entered. George says it's only 20 pounds and is powered by an Enya V-240. The magnificent Cat has a sliding canopy and operating tail hook. It took only six months to build, but then, those were the six months of daylight, so it figures!

SCALE FOR THE FUN OF IT

For those of you who haven't caught the bug yet, fun scale is probably the fastest growing segment of our sport. Fun-scale models are those that resemble all sorts of full-scale aircraft but don't have all the ornate detail that's required to compete at the Nationals. Fun-scale models can have very accurate outlines with a sport airfoil, not so accurate outlines with a pattern airfoil, or way outta-scale outlines with a flat-bottom airfoil. Anything goes as long as one very important factor remains intact. That factor? Easy; the model must be easily recognizable. Take a look at John Chapis' portrayal of a T-6, and I think you'll get the general idea. As ridiculous as a purist may say John's T-6 looks, I'll betcha a bazillion that anyone will recognize it for what it is! And that's what fun scale is all about. Anything from the most perfect scale model to the simplest can be flown in fun-scale events; and boy, there are lots and lots of these every year. Check out the AMA contest calendar if you don't believe me.

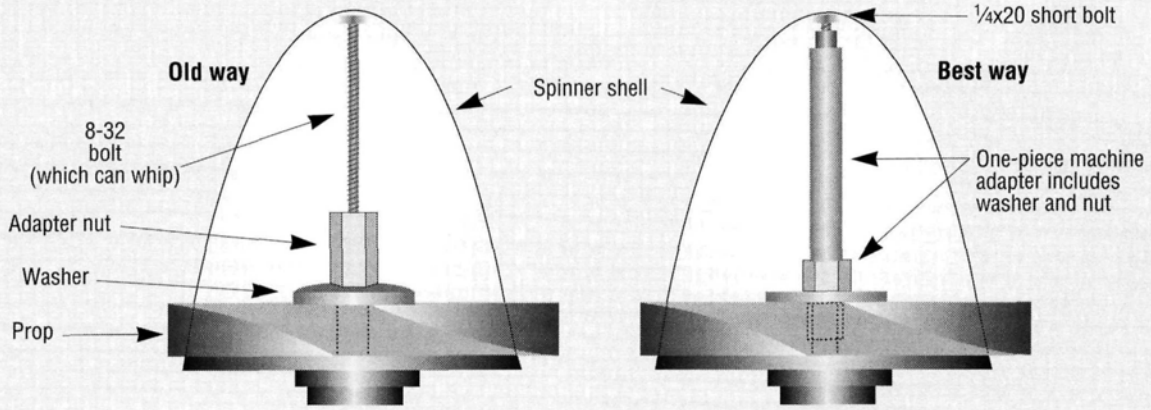
This is Jeff Foley and his brand-new Jet Model Products T-33 that took fourth at the last Scale Masters—not bad for a new bird with only four flights on it! The T-Bird weighs just 25 pounds and uses the Tom Cook/jmp fan unit and an O.S.* 91. Look for it at Top Gun in April.*

Glen Roberts is another name from the past that you may remember from the 1990 Scale Masters. Glen shows us his new 90-inch DH88 Comet, powered by a pair of Saito 45s. Underpowered, you ask? No, Mr. Too Much Prop; the thing only weighs 11 pounds! Glen uses silk and dope followed by K&B primer and paint for a sturdy but light finish.

FRIENDLY COMPETITION

But you hate any form of competition, you say. I understand. In fact, most regular modelers agree that competition can

SECURE SPINNER MOUNTS



Many have questioned why large spinners sometimes fly off the front of the engine after just a few minutes of running. Is it the engine, the spinner, or something else? The answer here is something else! The weak link is the attachment bolt—usually an 8-32-size—that runs from the nose of the spinner back to the special adapter nut. Depending on the distance between the end of the nut and the nose of the spinner, there's an excellent chance that the bolt, if it's too long, will vibrate and actually start to whip around. Eventually, the long bolt will fail under all that stress, and the spinner shell will come flying off. This is pretty dangerous and can be even worse when a large-diameter plastic spinner is used, because the shell sometimes shatters.

To solve the problem, we need to use a specially crafted spinner nut that indexes the prop into place while forming a secure stanchion for a much shorter and more robust bolt. The only company I know of at this time that makes such a device is Robinaire*, a small manufacturing concern in Lake Worth, FL. Check out the illustration to get an idea of exactly what Lee Robinson has done to correct this problem; and either buy what you need from him or have your machinist make one for you. In my opinion, this is the safest way to mount a spinner to anything over a .90-size engine.

Drawn by Patrick McCurry

be—and probably is—a pain in the proverbial phistaris. However, I'm here to tell you that fun scale is a different type of event; one where I can almost guarantee you an excellent time. If you can fly a little better than average, fun scale will be an absolute gas. In fun scale, only five points are awarded for documentation; that's it. So, if you don't have any, don't want any, or just forgot it, nothing of any consequence is lost.

The major part of your fun-scale score comes from flying. You're scored on nine flight maneuvers and one overall realism presentation. You fly anywhere from two to four rounds and, at the end, the guy with the best average flight score is the winner. Of the nine flight maneuvers, four of them are mandatory and five are done at your option. The mandatory ones include:

- a takeoff;
- a flyby;
- a figure-8;
- a landing.

The optional ones can include any maneuver described in the AMA rule book or any that are prototypical of the full-scale subject. Typically, WW II fighters do aerobatic maneuvers while Cubs and the like do overshoots, touch-and-go's and stall turns. Simple, yet fun, all maneuvers are scored from one to 10 points. Almost every contest I attended this past year had a fun-scale division, and it usually had the greatest number of contestants—guys like you and your buddy over there, just looking for something fun and easy to do. Talk about a significant bang for your buck!

START HAVING FUN

Where do you start? Well, I guess that your favorite hobby shop might be the safest and quickest way to get high. There you'll find sort-of-scale kits by several recognizable manufacturers. Size means nothing. Fun-scale airplanes can be anything from a 100-inch Jim Meister* Me-109 to a lesser-detailed Dave Platt* Jungmeister, or something in between a 50-inch Midwest* P-51 and a 72-inch Dynaflite* Spitfire. Get the picture? A host of companies make accurate-scale, semi-scale, sorta-scale, squint-scale and sloppy-scale airplane kits. As long as you can recognize them for what they're supposed to represent, go ahead and grab one, and then have yourself a ball.

FROM THE SUGGESTION BOX

Some have written and asked if there's an alternative set of landing gear for their new Midwest T-6 kit. The answer is yes. You have a choice of two different sets of gear—one manufactured by Robart* and the other by Century Jet Models*. Both sets will fit the T-6 like a glove, and I can almost guarantee that if one set is back-ordered, the other will be available.

John Chapis of Chapis Plans has cool plans for several skinny-scale electric or glow-powered airplanes that are just right for fun-scale competition. These all-balsa planes can be covered with plastic films. The Spitfire spans 54 inches and flies great on a .30-size engine. The T-6 does the same, or it can be powered by a geared 25 electric operating on 14 cells. Plans average a mere $12!!*

SPEEDY PAINT PREP

Is there an alternate way to prepare a glassed surface for paint, other than spraying primer? Yes. Pat McCurry brought some new techniques to our workshop, and here is his method: sand your glassed wing with a sanding block until it's as smooth as possible. Make a slurry of K&B* primer, primer catalyst and microballoons. The consistency should be similar to a wet concrete mix. Use an old brush to apply a liberal coat of the mixture to the wing's surface, and repeat with a second coat as soon as you've finished applying the first. Let the entire "mess" cure for about 4 hours at 75 degrees or warmer (8 hours if your temp is below 75), and then go back and block-sand the surface. Wipe the residue off with a rag that's dampened with denatured alcohol, and follow up with a tack rag. All the glass weave should be filled at this time; if it isn't, go back and repeat the procedure. Guess what? You're ready for paint!

NEWSBREAKING STUFF

• Just in case you've been off on safari, here's some industry news to whet your appetite for spending some dough. First, it's nice to see that Ace R/C* is back up and running under new management. So you'll still be able to get those neat electrical devices and some cool airplane kits. Best of all, the word is out that Ace will start the process of updating its entire line to keep pace with some of those expensive imports. It took the efforts of Top Flite (to redesign their Mustang, P-40 and Corsair) and Midwest's introduction of their 82-inch T-6 to rekindle some competitive spirit among several kit manufacturers. So what's on the drawing boards? I'm not allowed to tell from whom, but I can tell you what to look for in the coming months. How about an 80-inch Beech T-34, an 84-inch Piper Commanche, or a 120-inch P-38 (done like only you-know-who can do it!).

• Bob Violett Models* has a very limited number of those big F-4 Phantoms for sale, and they're shipping right about now.

• Don Smith Plans* has the new A-20 available to complement his A-26, and the Cessna Bobcat is just about ready.

• Jerry Bates Plans* has just released the new plan for the P-40B, and that makes Bates the only firm to have every single variant of the P-40 available, right up to the P-40N, and including the radial-engine version—the P-36. Look for a 98-inch Lockheed Ventura PV-1 in about one more month.

• The Ziroli* family is hard at work once again. Nicky Jr. is just completing a 96-inch P-47 that I'm told is truly awesome, while Dad—Nick Sr.—is finishing up his P-38 and a new, even larger, B-25!

• Palmer Plans* gave us a look at their Grumman Tigercat and B-24 Liberator plans, and they get the job done. A little busy, yes, but complete. And Palmer has plans for several other warbirds, including an A-26 in a smaller size than Don Smith's.

A shot of the new mixture control from Atlantic R/C Products. After the fuel tubing has been placed through the valve, the rotating arm can control fuel flow by changing the position of an internal cam. The bent-wire piece is used as a remote needle valve if a remote mixture isn't required.

MIXTURE-CONTROL VALVE

There's one new gizmo to tell you about this month. Atlantic R/C* has introduced a new mixture-control valve that promises to be exactly what you've been looking for, and then some. Atlantic's valve differs from most in that it's fairly inexpensive (make that cheap) and can act as an in-flight mixture control and/or a remote needle valve. The principle is quite like that of some of the valves used in the medical field. Simply route your fuel tubing through the valve, and let the rotating cam pinch off the supply of fuel to lean it out, or rotate the cam in the opposite direction for a richer setting. If you're interested, write to or call Doug Braddock, and ask for the product explanation sheet.

So there you have it. Another month of scale chitchat brought to you in a way that no other magazine can even challenge. Until next time, do your part for boosting the economy; visit your hobby shop. Later dude, your six is cleared.

**Addresses are listed alphabetically in the Index of Manufacturers on page 131.* ■

HOW TO

Tailless Airplane Design Part 1

by ANDY LENNON

An alternative to conventional aircraft design

THE FLYING WING has intrigued designers since the early days of flight. Its structural simplicity, graceful flight and low weight and low drag potential have major appeal. Despite this, no full-scale, tailless airplane or flying wing has ever been produced in quantities that could rival those of conventional aircraft. This article explores the pros and cons of tailless design.

CENTER OF GRAVITY LOCATION

For longitudinal stability, the CG of any type of airplane must be ahead of its neutral point, or NP (see "CG Location," *Model Airplane News* April '93). On a conventional (with tail) airplane, the horizontal tail's area and its distance from the wing (both horizontally and vertically) determine the NP location. It is possible to have the CG ahead of the wing's aerodynamic center (which lies at 25 percent of the wing's mean aerodynamic chord) or behind it and still maintain an adequate static (stability) margin between the CG and the NP behind it (see "Horizontal Tail Design," Parts 1 and 2 in the November and December '93 issues).

On a tailless aircraft, the wing's aerodynamic center (AC) and the NP coincide. For longitudinal stability, the CG must be ahead of the AC/NP location. This results in a nose-down imbalance. For equilibrium, the wing must provide a balancing force as shown in Figures 1A, 1B and 1C.

For a conventional airplane, this balance is achieved by the horizontal tail, which is at some distance behind the CG to provide a long moment arm, so that a relatively small tail area does the job.

For a tailless aircraft, the wing itself must provide this balancing force. On a straight wing (Figure 1A), the moment arm is short, so a larger balancing force is required to produce the moment needed. To increase the length of the moment arm, designers have resorted to using wide chords, forward and backward sweep and delta wings (an extreme example of sweepback).

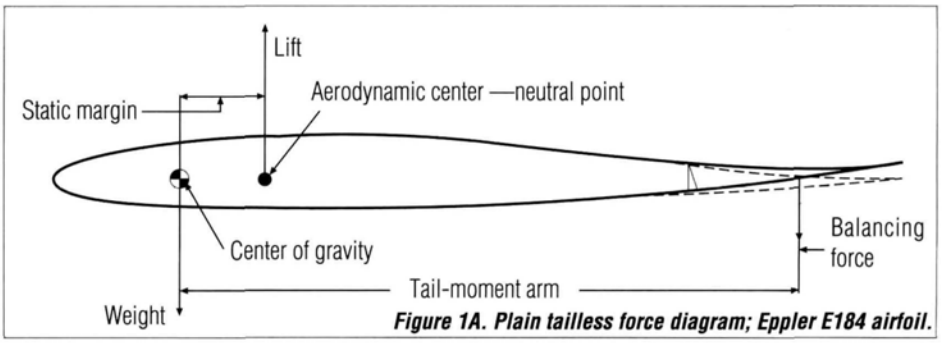


Figure 1A. Plain tailless force diagram; Eppler E184 airfoil.

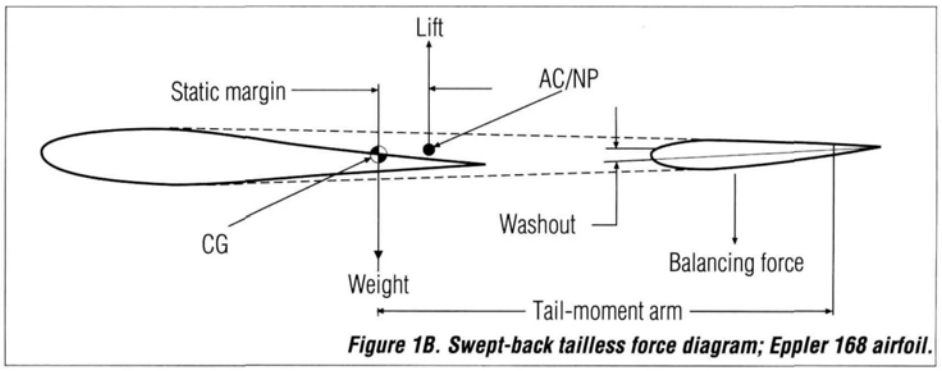


Figure 1B. Swept-back tailless force diagram; Eppler 168 airfoil.

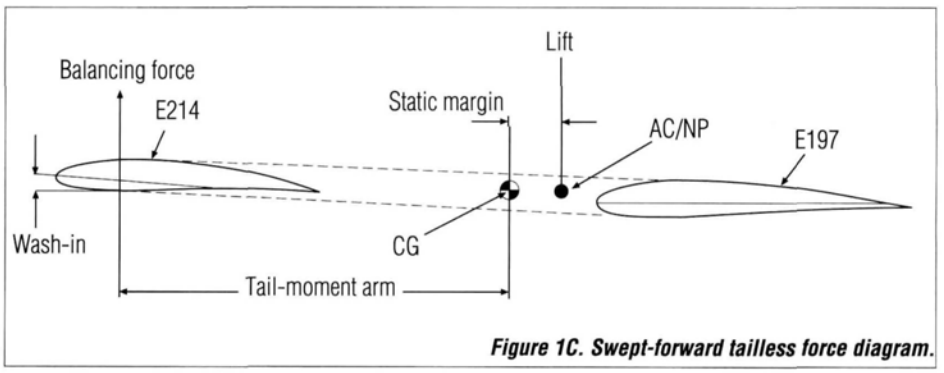


Figure 1C. Swept-forward tailless force diagram.

• For plain *swept-back and delta wings,* the balancing force acts downward, *reducing* the wing's lift and requiring additional wing area to compensate (Figures 1A and 1B).

• For a *forward-swept wing,* the balancing force acts upward, *increasing* the wing's lift. This allows less wing area and higher wing loadings (Figure 1C).

Owing to the high balancing forces needed, a tailless airplane is especially sensitive to CG location.

AIRFOIL CHARACTERISTICS

With their limited tail-moment arms, tailless airplanes—with the exception of forward-swept versions—*cannot* tolerate airfoils that produce high nose-down pitching moments; such airfoils are those that have heavily cambered mean lines (see "Understanding Airfoils," January '95).

Figures 2 and 3 show lift, drag and

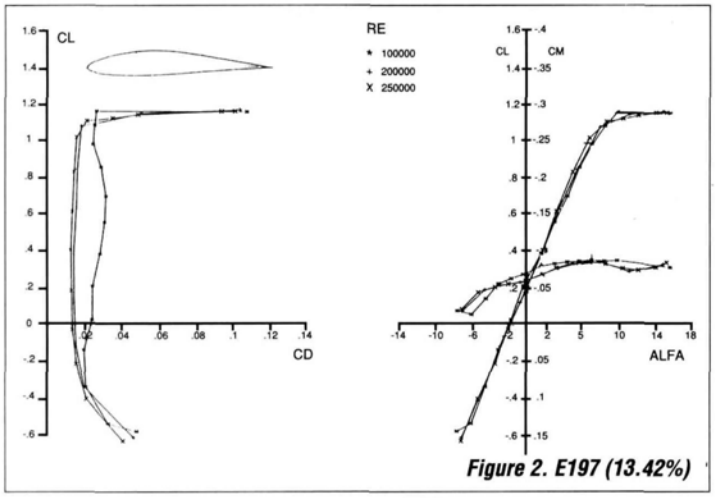


Figure 2. E197 (13.42%)

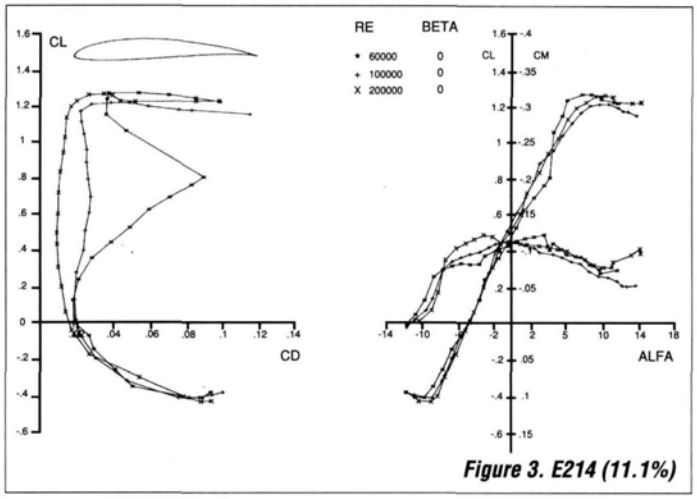


Figure 3. E214 (11.1%)

pitching moments for two cambered airfoils (E197 and E214). Such airfoils, when used on a tailless airplane, call for a substantially greater balancing force. Some early, full-scale, tailless designs that employed cambered airfoils had sweepback and inverted, washed-out airfoil sections toward the wingtips. This provided the balancing force, but certainly did not improve the wing's lift.

To reduce or eliminate the airfoil's nose-down pitching moment, symmetrical airfoils or airfoils with reflexed mean lines were used. Figures 4 and 5 illustrate two reflexed airfoils (E184 and E230); E184 has a low nose-down pitching moment, and E230 has a nose-up moment. An E184 airfoil inboard with an E230 airfoil toward the tips on a swept-back wing could provide sufficient balancing force. Figure 6 shows E168—a symmetrical airfoil that has no pitching moment, except at the stall during which the airfoil becomes nose-down and is stabilizing.

However, reflexed and symmetrical airfoils have substantially reduced maximum lift coefficients; E214 has a coefficient of lift (CL) max. of 1.25 (Figure 5), whereas E230 (Figure 6) has a CL max. of only 0.78. Since both stall and landing speeds are directly related to the airfoil's CL max., these reduced values result in substantially higher landing speeds, or they necessitate an increase in wing area (lower wing loadings) to achieve those lower speeds.

HIGH-LIFT DEVICES

The lift that a wing generates is proportional to the square of its flying speed. Assuming a constant angle of attack, doubling the speed increases lift fourfold.

At high speed, it's obvious that less wing area is required (see "Wing Design" Parts 1, 2 and 3, in the January, February and March '93 issues). At high speeds, less wing area means reduced drag—both profile and induced—but substantially higher stall and landing speeds. The GB racers of the '30s reflected this philosophy, and they landed "hot."

To provide slower landing speeds with *reduced wing area*, the modern approach is to use high-lift (HL) devices (such as split, slotted, or Fowler flaps) on the wing's trailing edge (combined, in some cases, with leading-edge slots and flaps). Use of these devices results in very large increases in the wing's CL max.

Under the conditions described above, the wing's area is determined by its high-

The Plover

Several years ago, this author developed a swept-forward tailless glider called the Plover. The parallels between it and canard design are evident. The straight outer panels equate to a canard's foreplane, and the swept-forward inner panels are like the canard's aftplane. A vertical tail area close to 10 percent of the wing's area was required for directional stability.

This model was not particularly successful. In other than a wings-level landing, the outer panels were easily damaged and it was CG-sensitive, but it proved the validity of canard technology, which will be discussed in an upcoming three-part article entitled "Canard, Tandem Wings, and Three Surface Design."

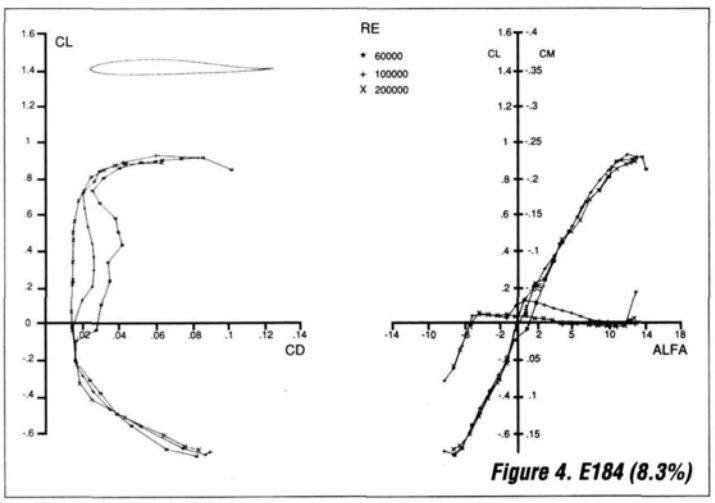


Figure 4. E184 (8.3%)

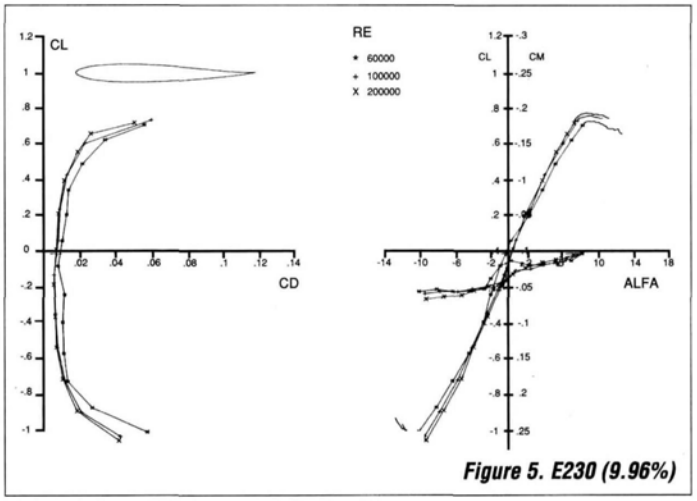


Figure 5. E230 (9.96%)

lift-device-assisted CL max. and the landing speed desired. Unfortunately, when deployed, these high-lift devices produce heavy nose-down pitching moments that are beyond the capability of tailless aircraft (with the exception of forward-swept types).

On conventional "tailed" airplanes, the increased nose-down pitching moment is compensated for by the heavy downwash angle increase provided by the deployed HL devices striking the tail, and by stabilizer/elevator action. Obviously, on a tailless airplane, the wing's downwash provides no such compensating force. Small split-flaps were used, inboard, on some swept-back tailless airplanes, but these produced more drag than lift.

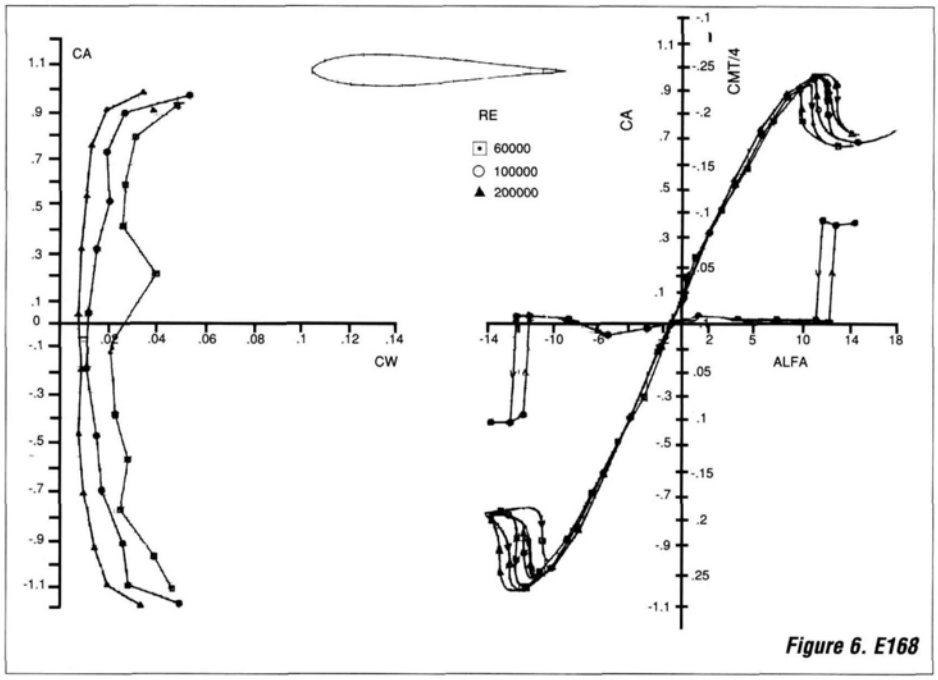


Figure 6. E168

SUMMARY

For tailless airplanes (except SF) all three factors—CG location, reduced airfoil CL max. and limited use of HL devices—require an increase in wing area compared with conventional aircraft, and this reduces the tailless craft's efficiency.

This author's Swift has 600 square inches of wing area and weighs 92 ounces (gross) for a wing loading of 22 ounces per square foot. Its airfoil is the E197, and it is equipped with slotted flaps whose chord is 30 percent of wing chord, and which occupy 60 percent of the wing's trailing edge. The CL max. (flaps extended 40 degrees) is 1.80; stall speed is 17mph.

For a tailless aircraft with a wing CL max. of 0.90 to achieve the Swift's stall speed would require a wing loading of 11 ounces per square foot. Because of the lower loading, a substantial increase in wing area and weight would result. It is not improbable that this increase would equal the weight savings resulting from a shorter fuselage and absence of a horizontal tail. Using the Swift's gross weight of 92 ounces, to achieve the 17mph stall, the wing area for a tailless model would be 1,200 square inches—a 100-percent increase. Top-speed performance would be adversely affected.

SWEPT-FORWARD TAILLESS AIRCRAFT

Of the tailless configurations, only the swept-forward (SF) has an upward lifting balancing force, which adds to the wing's overall lift, rather than the downward, lift-reducing balancing force of the other configurations.

Very few SF tailless aircraft—either full-scale or model—have been designed and built, owing to two major factors:

• The SF wing has a strong tendency to twist under load, increasing its angle of attack. Unless the wing is torsionally very strong, this tendency leads to flutter and disastrous failure. A stiff, heavy structure is needed. Modern, composite, stressed-skin design has largely overcome this problem.

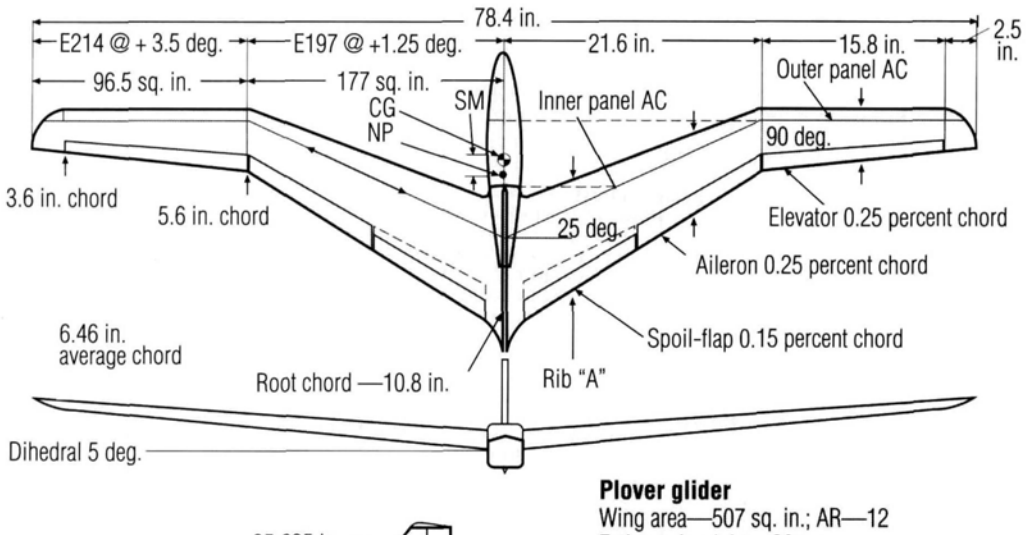
• An SF wing is directionally unstable (see "Spiral Stability," July '94 issue) and requires large vertical surfaces for directional stability.

Since lift is all upward, the nose-down pitching moment of cambered airfoils is easily overcome with an SF wing. Such airfoils, with their higher CL max., may be used.

High-lift devices, such as slotted flaps, may be incorporated at the inboard trailing edges. Elevators are depressed at the wingtips to increase lift forward of the CG and offset both the added lift and the nose-down pitch of the extended HL devices that are behind the CG. In this condition, both elevators and flaps add to the wing's total lift.

An SF wing characteristically stalls at the wing root first. Because this area is aft of the

(Continued on page 125)



Plover glider
Wing area—507 sq. in.; AR—12
Estimated weight—32 oz.
Wing loading—9.09 oz./ sq. ft.
Controls—elevator, aileron, rudder, spoil-flaps

Figure 7. The Plover glider.

FIELD & BENCH REVIEW

PART 2 **BYRON**

AT-6 TEXAN

by FRANK PONTERI

The project continues—engine installation, more building details

IN PART 1, I covered most of the Byron* AT-6's basic construction. It's now time to look at engine choices and installation, and, given the complexity of this project, I'll offer some additional construction details.

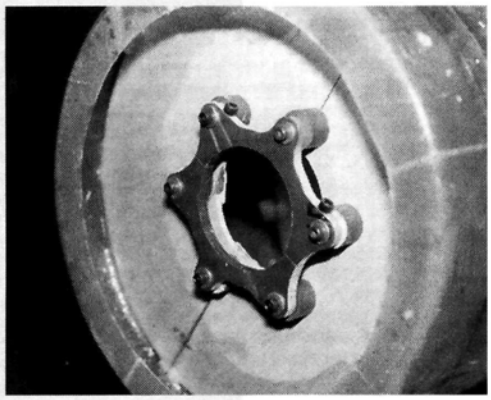
ENGINE INSTALLATION

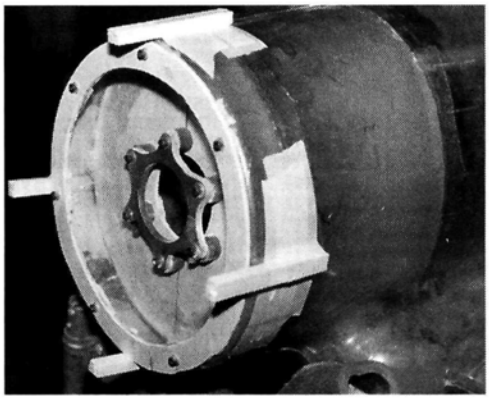
Byron Originals offers two engine options for the AT-6: a 4.2 or a G-62 installation. Most air races require a stock Zenoah G-62 for power. In each installation, you choose the engine mount and the muffler. The Byron PurrrPow'r mount is one option. Used on many other Byron aircraft, this mount has a muffler built in and is available for the 4.2 and the G-62.

For both engines, a straight mount is available, and it allows a choice of mufflers. Byron also produces a custom muffler for the G-62; it allows the exhaust gas to exit the aircraft in the scale location (a requirement for AT-6 races).

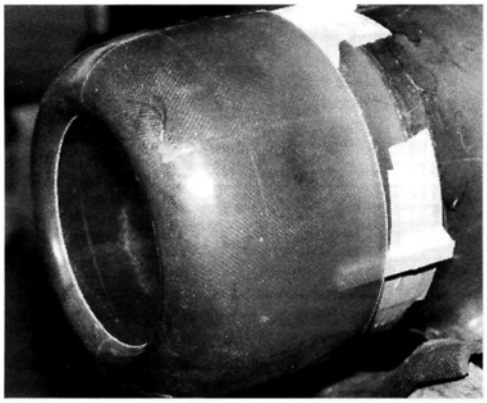
I chose the G-62, a straight mount and the Byron scale exhaust muffler. This Byron engine-mounting system is installed on two ⅛-inch plywood formers. You must decide on an engine before you install the formers. If you use a G-62 with a spring starter, you'll have to move the front former 1½ inches back. Don't install the formers until you've bolted the aluminum rings that hold the engine mount onto them. Then glass the formers into place in the fuselage. The front cowl ring is positioned with the use of spacers and then epoxied and bolted onto the front lip of the fuselage. After installing the cowl, you'll be able to ascertain the proper length of the straight mount.

At this point, I chose to deviate from the plans and used Prather Products* Flush Fitting Camlocks to install the cowl. I glued hardwood blocks onto the cowl ring. The camlocks are mounted on these blocks. Secure the cowl to the fuselage, then measure the distance from the rear engine former to the front of the cowl and add ¼ inch. Bolt the engine onto the mount, and measure the same distance from the face of the thrust washer back along the mount (engine former to the front of the cowl plus ¼ inch). Cut the mount off at this mark. Mount the muffler



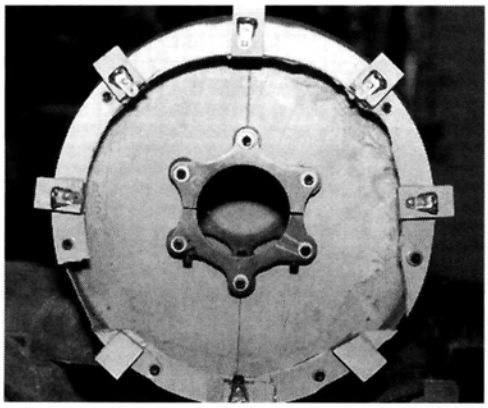


The aluminum rings that hold the engine mount are bolted to the front former.

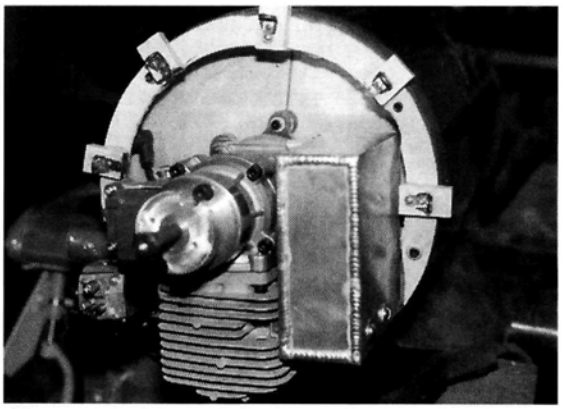


Above: when you epoxy and bolt the front cowl ring to the front lip of the fuselage, tape balsa spacers to the fuselage to position the cowl properly.

Left: the cowl is slid over the spacers and then secured to the fuselage using the mounting hardware supplied with the kit.

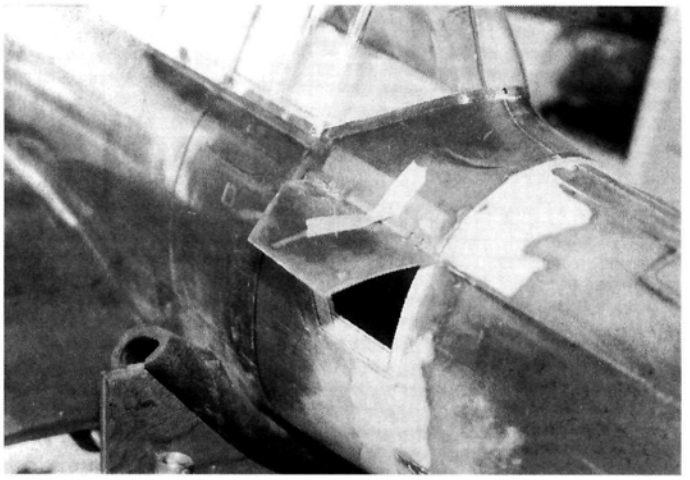


I used Prather Products flush-fitting camlocks to install the cowl. The camlocks are mounted on hardwood blocks glued to the cowl.



I have notched the cowl ring in two places to allow the muffler and the exhaust pipe to slide back into the fuselage.

The outboard flaps are driven by the center-section flap by means of a mechanical linkage.



This hatch will hold the JR on/off/charge switch and the air-filler valve for the retracts.

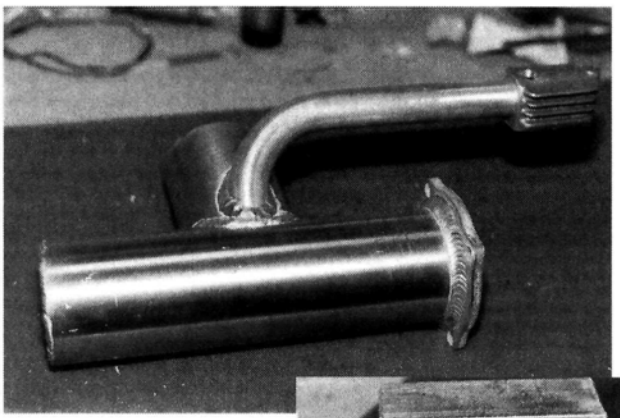
on the engine and slide the assembly into place.

To allow the muffler and exhaust pipe to slide back into the fuselage, you'll have to notch the cowl ring in two places. Bolt the cowl back into place, and install a prop on the engine. Check the clearance between the prop and the cowl, and make all the necessary final adjustments.

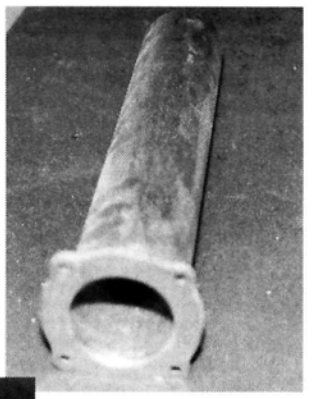
OTHER INSTALLATIONS

• **Utility hatch.** In the left fuselage side just below the rear of the canopy, the AT-6 has a compartment hatch molded into the fiberglass. I cut out this hatch and hinged it back on the fuselage with two small Du-Bro* hinges. Then I used ⅛-inch balsa as a frame and secured it to the interior of the fuselage with PFM (from Innovative Model Products*). A Bob Violett Models* hatch latch holds the door closed, and this hatch will hold the JR* on/off/charge switch and the air-filler valve for the retracts.

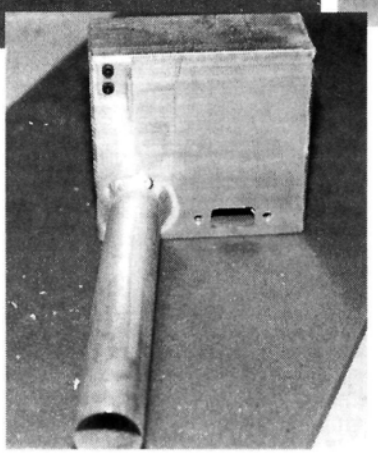
• **Flaps.** The AT-6 has three-part split flaps; each wing panel and the fuselage center section contains a flap section. A single ¼-scale servo drives the center flap, which, through a linkage, drives the outer flaps. Although the center-section flap would be enough to fly the aircraft, the three-part flap adds a scale look.



The Byron PurrrPow'r engine mount, used in many Byron kits, has a built-in muffler.



The straight-mount option is compatible with a variety of popular mufflers.



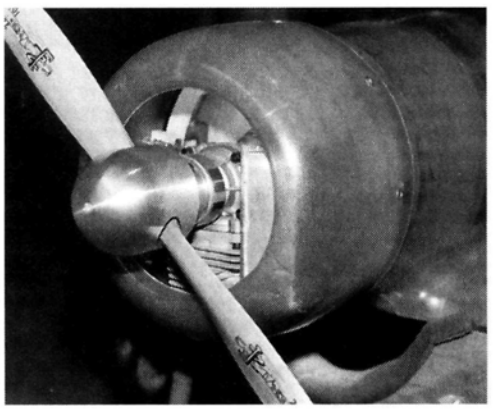
The Byron scale exhaust muffler—a requirement in giant-scale racing.

• **Pneumatic notes.** The pneumatic retracts system can be installed before or after you paint the aircraft; I prefer to do it before painting. All the items you need are available from Byron in the optional pneumatic air system package (it doesn't come with the landing gear). This is a basic installation because you only have to activate the main-gear retracts; there are no gear doors or tail wheel to worry about. Mount the air valve at the front of the aircraft, as shown on the plans, and install the actuating servo (a standard servo). The air bottle goes behind the cockpit; I used PFM to hold it on the fuselage's inside wall.

Hook up the air lines, pressurize and check for leaks. I use an electric air pump that was designed to inflate a car tire (available from auto-supply stores). These pumps have air gauges that indicate pressure, so they'll tell you if air is leaking out. You can also apply soapy water to possible leaks, and if you see bubbles, you'll know you have a problem.

In Part 3 of this article, I'll discuss the radio installation, balance and setup, final details and performance. A number of modelers have raised questions about the best types of adhesive to use in this type of construction, so I'll also summarize those that worked best for me. Until then, remember, "Big is better."

**Addresses are listed alphabetically in the Index of Manufacturers on page 131.* ■



PHOTOS BY FRANK PONTERI

The completed engine installation with True-Turn spinner attached.*

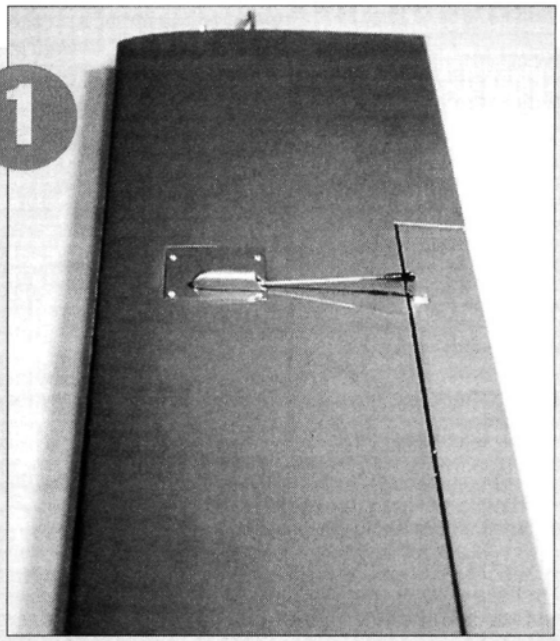
HOW TO

Build a Low-Profile Servo Mount

by FAYE STILLEY

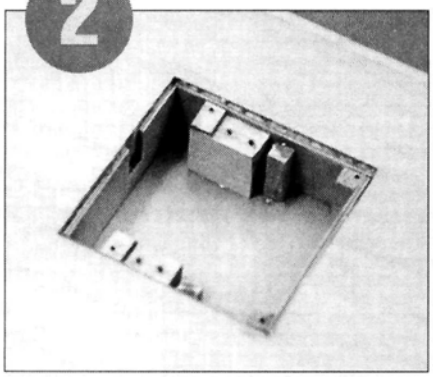
Protect your servos with this scale-like mounting system

FACED WITH the problem of a thin airfoil into which my servos would not fit upright, I had to come up with a way to mount the servos on their sides. I also wanted the installation to look good and to protect the servos from fuel and dirt. The servos also had to be accessible for inspection and service if necessary. The solution turned out so well that, in the future, I'll mount all my wing servos this way.



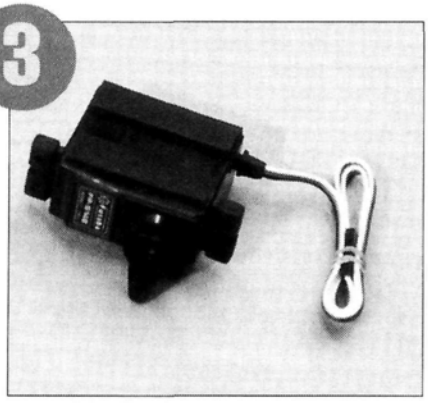
1

I never did like the appearance of a servo sticking out of a wing. It makes the wing look unfinished. Mounting the servo on its side puts the control arm perpendicular to the wing surface and makes the plane look much more like a full-scale aircraft (not to mention the protection the servo gets from being covered).



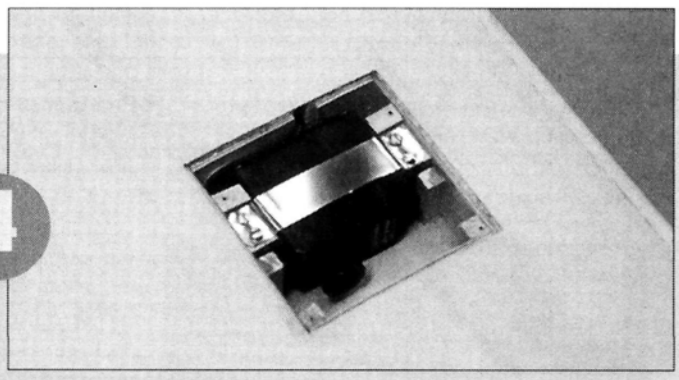
2

I made the servo-mounting box of 1/16-inch aircraft ply. I had just enough depth in the wing to mount it and leave 1/16 inch clearance below the wing skin and the box for the cover plate, which I also made of 1/16-inch aircraft ply. The "posts," which are visible in the mounting box, have specific purposes, which I will explain later. I made this box for a Futaba 148 servo. Its final size was 2½ inches square by 1 5/16 inch deep. The size of your box will be determined by the size of your servo.



3

Before installing the servos, I put foam-rubber wing-saddle tape on the side that rests on the bottom of the box. This was to provide protection from vibration. When I calculated the depth of the box, I compensated for the thickness of the foam-rubber tape.



4

The servo is held snugly in the box by a metal strap, and there's a piece of rubber electrical tape between the strap and the servo. I would have preferred to use wing-saddle tape, but there just wasn't enough space for it in this wing with this servo. The metal strap was made of a piece of brass shim stock. It is held in place by four no. 2 sheet-metal screws.

Before you build the box, take an accurate measurement of your servo. Start with a scale drawing of the side of your servo, then calculate the measurements of the mounting box (see "Build a Servo Box" sidebar). Save the drawings of your servo! Put them on poster board or Mylar and cut them out. You'll find many uses for them to help in accurate placement of servos of the same size.

continued

Build a Servo Box

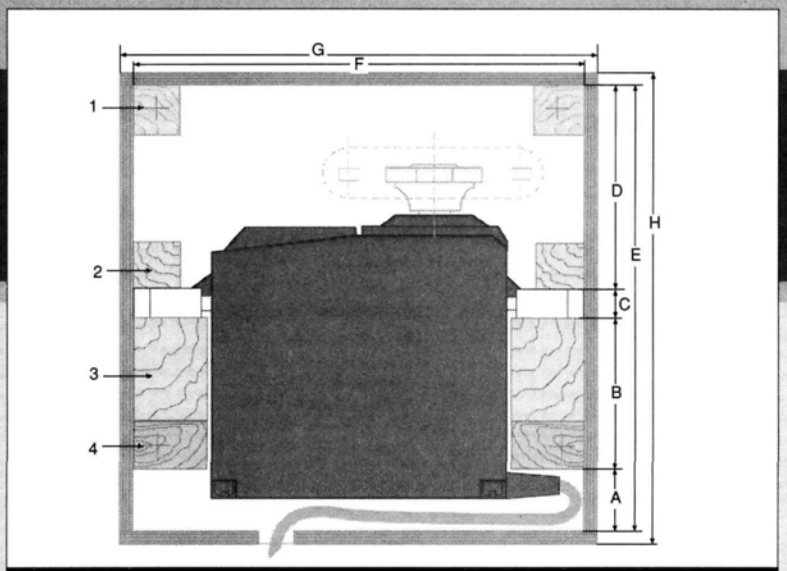


FIGURE 1

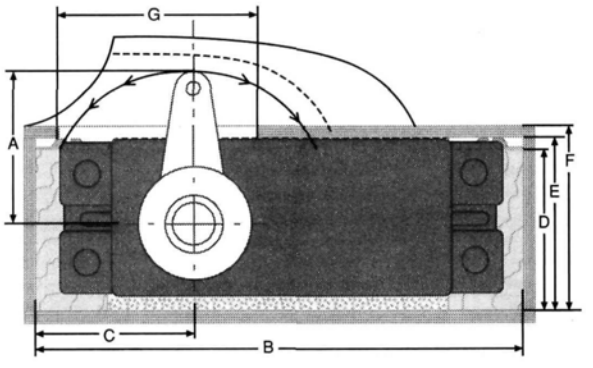
Figure 1
There are eight "posts" in the box. Each has its own purpose. The no. 1 posts accept the screws that attach the cover plate to the box. I used ¼-inch-square hardwood. The no. 2 posts secure one side of the servo-mounting lugs. I used ¼-inch-square hardware for these posts as well. The no. 3 posts secure the other side of the servo-mounting lugs and provide a mounting surface for the metal strap that holds the servo in place. I used ⅜x¾-inch hardwood. The no. 4 posts are shims made of plywood and glued on top of the no. 3 posts. They're there to provide a surface (flush with the top of the box) that will accept the second set of screws that hold the cover plate in place.

Using the drawing of your servo, take the measurements for the box, and calculate where the posts should be mounted. Measurement A should allow for the strain relief of the servo and space for the wire to travel under the servo to the point at which it enters the wing. Measurement B is the distance between the strain relief and the bottom of the servo-mounting lugs with the rubber grommets installed. Measurement C is the thickness of the mounting grommets when they're installed, plus an "eyelash" to allow easy insertion and removal. Measurement D is the distance necessary to give the top part of the servo and the servo arm plenty of clearance. When determining this measurement, take into consideration the size of the no. 1 posts. Measurement E is the total of A, B, C and D. It is the inside dimension of the box. The other inside dimension, measurement F, is determined by the length of the servo, plus 1/32-inch clearance between each no. 3 post and the servo, plus the size of the stock selected for the no. 3 posts. Measurements G and H are the outside dimensions of the box. They are dictated by the thickness of the plywood you're using for the box frame. Measurements G and H are also the dimensions for the cover plate and the base of the box. This drawing also locates the servo-arm slot, which will be cut in the cover plate. When you calculate the width of the slot, make an allowance for the width of the clevis you plan to use, plus any keeper device.

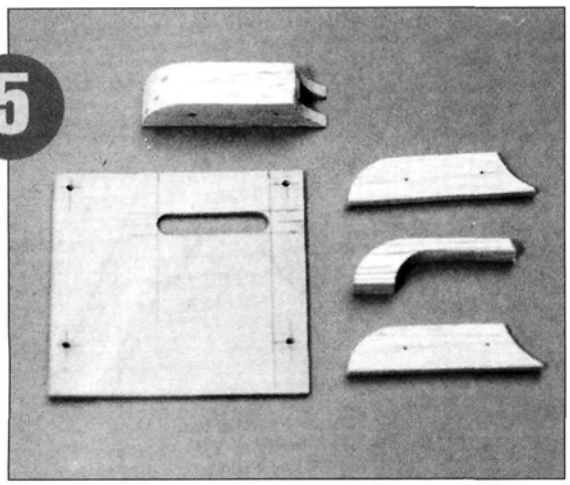
Figure 2
Begin these calculations by drawing a scale top view of your servo. Draw the servo arm, and with a compass, mark the radius of the arm's travel (measurement A). This is important in determining the position of the slot in the cover plate and the internal size of the cowl. Measurement B has already been determined. It is the same as measurement F on the first drawing. Measurement C can also be taken from the first drawing. These two measurements provide the starting point for determining the rest of the measurements. Measurement D is the width of your servo, plus the thickness of the wing-saddle tape, minus enough space for the hold-down strap and the screw heads that hold it in place. Note: if you use wing-saddle tape on both sides of the servo, that comes into the calculation as well. Measurement E is the calculation you made for measurement D *before* you subtracted space for the hold-down strap and the screw heads. Measurement F is equal to E plus the thickness of the plywood that you have chosen for the cover plate. After F has been drawn on the plan, measurement G can be calculated by measuring to the points where the previously drawn arm radius intersects F.

From this drawing, the height of the posts is determined. The no. 1 posts are the same as measurement E. The no. 2 and no. 3 posts are the D measurement. The no. 4 posts, which are shims, are of a thickness that's the difference between measurement E and measurement D. The tops of posts no. 1 and no. 4 should be flush with the top of the sides of the box E. This prevents the cover plate from being depressed when the fastening screws are tightened down.

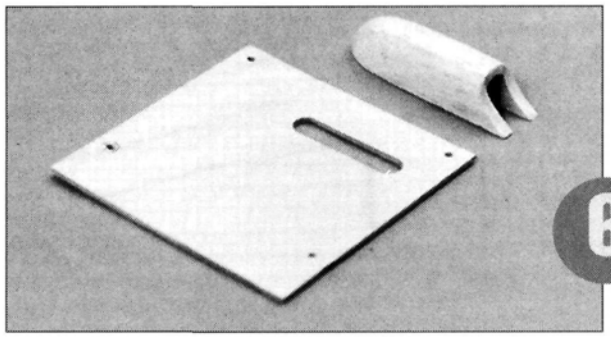
FIGURE 2



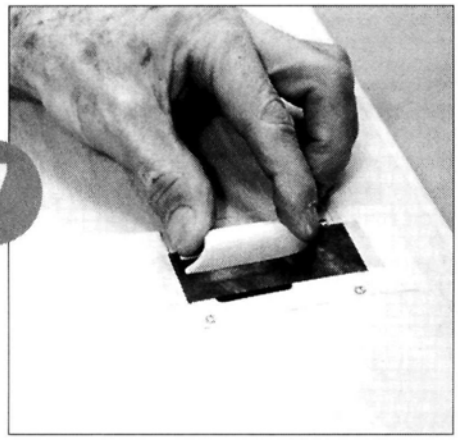
(Continued from page 64)



I used plywood for the cover plate because the plate must be strong enough to take the pressure from the fastening screws. Plywood bends much more easily in one direction than the other. Cut the cover plate so that it will bend easily from fore to aft when installed on the wing. The slot for the servo arm has been cut and the holes for the screws drilled. To make the slot, I drilled holes of the proper size at each end and cut out the material between them. There are three parts to the cowl. It's made much like a wheel pant, with two sides and a center section. The center section is as thick as the slot in the cover is wide. The shape and size of the cowl parts was determined from Figure 2. The cowl in the picture has a ¼-inch-thick center section and ⅛-inch-thick sides.



The cowl has been shaped and final-sanded. The cover plate has also been sanded, and the parts are almost ready for assembly. Before gluing the two parts together, or before covering them, make one final fitting. Put the cover plate in place on the wing, and screw it down with the fore and aft edges flush with the wing sheeting. It should bend with the surface of the airfoil. If the airfoil has a pronounced curve at the point where the box is to be installed, you may have to install a small shim on the left and right sides of the box. The cover's surface will now be shaped as it will be when it's finally installed.

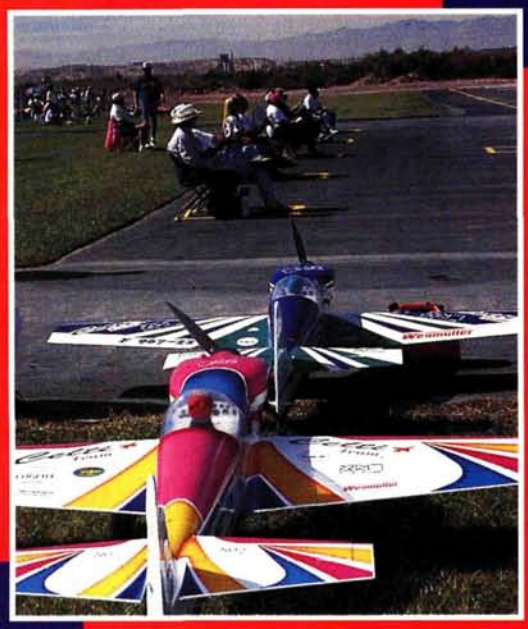


Tape sandpaper to the cover plate, and carefully sand the mounting surface of the balsa cowl, using a side-to-side motion. The cowl will now fit perfectly on the curved surface of the cover plate and will hold the cover plate's shape when it's removed. Final gluing of the cowl to the cover plate should be done with the cover plate in place on the wing.

The finished cover assembly feels as solid as metal. The combination of the plywood's being bent and its being held firmly in shape by the cowl gives it strength. I covered this one with film covering material before gluing the parts together. It's much easier to cover the parts separately. To ensure a good bond, a small amount of covering was cut away where the two parts meet.

The work was worth it. It allows easy access to the servo, and it's more aerodynamic than a hole with the servo sticking out. This unit was installed in a foam wing. It can also be installed in a wing with open bays by adding a spar fore and aft of the box between the two adjoining ribs. Once you've made a set, you'll never go back to the old way. Try it.

In the next issue, I'll tell you how to cover the servo mounts. ■



Chris Paysant-Le Roux's two Cap 231 EXs were on the flight line ready for every flight. It seems that there's something to be said for preparation.

Team Von Linsowe; Dave and the crew who helped him to fifth spot at this year's TOC. Notice the pilot in Dave's 300S—look familiar?

No, they aren't models! The Christen Eagles put on a spectacular aerobatics routine.

A winning combination: Quique Somenzini and his dad get ready for an unknown sequence.

THE CROWD stood motionless, eyes staring, jaws dropped low in disbelief. The eerie silence was broken only by the incessant buzz of propeller blades slicing air. Eyewitnesses struggled to distinguish between the illusion they were seeing and the principles of aerodynamics they were thinking. How could an airplane keep its nose and tail essentially level, yet descend and ascend yo-yo style without forward motion? No, this it wasn't a helicopter or a miniature Harrier. This seemingly impossible feat was being performed by master aviator and techno-wizard Quique Somenzini during the freestyle competition at the 12th International Tournament of Champions in Las Vegas, NV (October 27 through 30, 1994).

For those who are not familiar with the biennial Tournament of Champions (TOC) contest, let me explain some of the criteria. First, it should be known that this contest, which was founded by and is supported by William Bennett, chairman of Circus Circus Enterprises Inc., is by invitation only. Although the exact method used to select the 19 competitors is unknown, only the very best make it. Regardless of his ch

Tournament of Champions

The world's best aerobatic pilots compete for the largest purse

Chip Hyde's Ultimate flies a slow-speed pass while maintaining knife-edge flight.

Accompanied by Miss TOC, Debbie Ellis, contest director Steve Rojecki gives a beautiful trophy (from Circus Circus Enterprises) to this year's TOC champ, Quique Somenzini.

by NORM STAUB

Chris Lakin fires up his ... Sukhoi SU 26 MX to fly ...nd unknown sequence. ... wife, pit crew, caller ... friend Diana holds the ...ore the sequence.

Right: Steve and Pat Stricker when the work was over. With back-to-back second places at the TOC, what's next for Steve?

...g position, every TOC pilot is a ...n his own right. ...ecki, who made his debut as contest director in 1992, did a fine job of running the event with a terrific support staff. Along with Mr. Bennett's mention at the banquet, Steve addressed the rumor of the contest's demise and reaffirmed to me that the TOC tradition will continue. Steve was the first American to win the TOC ('84), and he placed second in 1990. These accomplishments and his experience with the Air Force and commercial airlines make Steve very valuable to the TOC.

(Continued on page 75)

This is the motor compartment of Chip's Ultimate. Notice the famous Hyde soft mount designed by Merle Hyde. It's the finest soft mount available. The engine is a Precision 8.8ci.

TOC Requirements

The models must meet the following requirements:

- must be a scale replica of a full-size aircraft, with no more than 10 percent deviation from scale;
- airfoils need not resemble those on the full-size aircraft;
- engine displacement must not exceed 8.8ci (145cc)—increased from 4.5ci (75cc) in 1992;
- wing area must be at least 1,400 square inches (monoplanes) or 1,600 square inches (biplanes). This year, monoplanes with wing areas that exceeded 2,200 square inches and biplanes in excess of 2,500 square inches were awarded a 1-percent scoring bonus. Monoplanes in excess of 3,000 square inches and biplanes with more than 3,300 squares were awarded a 2-percent bonus.

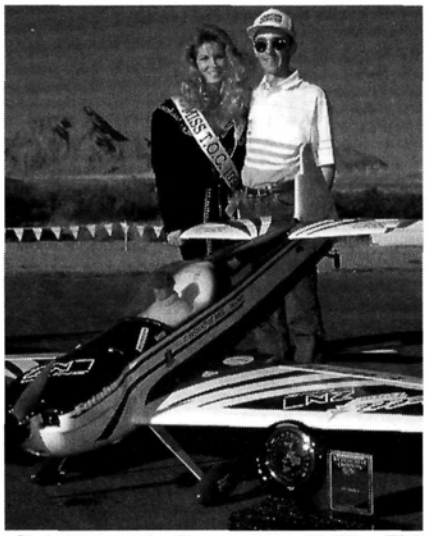
(Continued from page 71)

This was my fourth consecutive TOC; over this eight-year span, it's beyond belief how technology and pilot proficiency have evolved. As mentioned in the sidebar, the size of the motors doubled, and in some cases, the planes' sizes increased from about 30 percent in 1992 to 44 percent in '94! I heard scuttlebutt that some of the Europeans and the Japanese didn't attend because the cost of the machines for this TOC was a bit overwhelming. At the end of the contest, Dave Von Linsowe's Extra 300S was for sale at $10,000! Now, if that's the cost of *one* airplane, imagine what expenses the pilots incur to get to the TOC.

THE PLANES...THE PLANES!

Geoff Combs did a beautiful job on the design and glasswork of his Extra 300S. Steve Stricker and Dave Von Linsowe both flew them, and it's quite creditable that two out of three of Geoff's ships made the finals. If Geoff had solved his radio problems, I'm sure he would have placed higher in the final standings.

Other great building efforts included Chris Lakin's Sukhoi SU 26MX and *Model Airplane News*' columnist Dave Patrick's Bucker Jugmann. Futaba* radios were predominant, and the 3W 120 twin (distributed by Desert Aircraft*) was the dominant motor. Almost every plane had many custom parts and hardware.



Chris Paysant-Le Roux poses with Miss TOC (Debbie Ellis) after capturing third place. Foreground: his CAP 231 EX and third-place trophy.

Above: Chip Hyde holds on to his massive Ultimate, which is powered by a Precision Eagle 8.8ci engine. When it was at full power, Chip couldn't hold it without help.
Below: designer Geoff Combs with his Extra 300S during the first day of competition.

Pos.	Pilot/Country/Prize	Aircraft/Designer	Radio	Engine/Muffler	Prop	Spinner
1	Quique Somenzini/Argentina/$25,000	Extra 300S/Bob Godrey & self	Futaba 9 Zap	3W/Somenzini twin 7.2/Don Harris	Bolly 30.5x13	Tru-Turn
2	Steve Stricker/USA/$15,000	Extra 300S/Geoff Combs	Futaba 9 Zap 5	7.0 3W 2-stroke/Geoff Combs	MEN 30x12	Geoff Combs
3	Chris Paysant-Le Roux/France/$10,000	CAP 231 EX/ ZN Line	Futaba 1026Z	Sachs 95CC/Aerrow /Bolly	APC 28x16	Inline
4	Chip Hyde/USA/$8,500	Ultimate/Merle Hyde	JR	Precision Eagle/Slimline	Bolly	Tru-Turn
5	Dave Von Linsowe/USA/$7,500	Extra 300S/Geoff Combs & self	Futaba 9 Zap	3W-140CC 4B/Own	N/A	Tru-Turn
6	Jason Shulman/USA/$6,500	Extra 300S/Bob Godfrey	Futaba 9 Zap 1024	3W 7.0C Twin/Don Harris	Menz 30x10	Tru-Turn
7	Peter Goldsmith/Australia/$6,000	CAP 231X/Self	JR PCM 10S	Precision Eagle 5-8/Own	Super Cool 24x14	Super Cool
8	Mike McConville/USA/$5,500	Extra 300S/Bob Godfrey	Futaba 9 Zap	3W 120/Johnson	Glasner 30x12	Tru-Turn
9	Greg Marsden/Canada/$5,000	Extra 300/HAFU	Futaba 9 Zap	Precision Eagle/Own	APC	Tru-Turn
10	Chris Lakin/USA/$4,500	Sukhoi SU 26 MX/Self	JR	Aykes/Slimline	APC	Tru-Turn
11	Mike Klein/USA$4,000	Ultimate/McConville & self	Futaba 9 Zap	3W 7.0 61/3W	Bolly 28x12	Combs
12	Peter Erang/Germany/$4,000	Extra EA 300/Self	Futaba FC28	Titan 7G 62/Seyer	Maro	N/A
13	Peter Wessels/Germany/$4,000	Extra 300S/Lagemann	Graupner/JR MC-20	Zenoah 62/Seyer tuned pipe	Seyer 21x12	Own
14	Dean Koger/USA/$4,000	Laser 200/Wayne Ulery	JR PCM 10S	Aerrow A-140 twin belt/ own	Zinger	Tru-Turn
15	Geoff Combs/USA/$4,000	Extra 300S/Self	Futaba	3W/Own	30x12	Aerosport products
16	Dave Patrick/USA/$4,000	Bucker Jungmann/Self	Futaba 9 Zap	Infinity 8.8/Infinity	Glasner 30x12	Tru-Turn
17	Gene Rodgers/USA/$4,000	Sukhoi SU29/ Ultimate Sport	Futaba 9 Zap	3W 120CC/Custom	N/A	Tru-Turn
18	Bill Cunningham/USA/$4,000	E-260/Pirate Models	Futaba 9/Zap 5	A^3 8.8ci/own	APC 28x16	A^3
19	Colin Campbell/Canada/$4,000	Extra 300S/Ohio R/C	Futaba	Eric Dern/Aerrow	Mueller & Menz Holz	Tru-Turn

To compete in this game, you have to dedicate a lot of time exclusively to perfecting your flying skills and the technological status of your model—a pursuit that can be quite trying on personal relationships and outside careers.

DAY ONE

Most of the flying was quite good. Quique Somenzini and Geoff Combs had radio problems that adversely affected their presentation. Colin Campbell's ship went into radio hold and, when it at last broke loose, its wing folded and it crashed. Unfortunately, Colin had lost his backup ship before the contest, so he was out of it.

The biggest surprise was French newcomer Chris Paysant-Le Roux, who made it clear that he intended to make the finals. His geometry and technique were superb, leaving no margin for subjectivity in scoring—excellent textbook flying.

DAY TWO

Chip Hyde, Dave Von Linsowe, Quique Somenzini and Steve Stricker all flew spectacular unknown sequences. One of the top contenders, Bill Cunningham elected to pull out of the contest owing to motor problems.

We saw the first freestyle flight; TOC freestyle is a *must see!* Although credit must be given to *all* the pilots, Quique Somenzini's freestyle performance was like none ever before seen. As well as unbelievable torque rolls (of which Chip Hyde and Quique Somenzini are the masters), Quique made his Extra 300S hover, and he slowly moved it up and down while holding it in a horizontal position! Let me clarify this: the ship was not moving forward to create lift, yet it rose and fell as if suspended from a rope at the nose and tail—mind-boggling! At the end of the flight, the judges raised their brows in disbelief and joined the audience with applause. This presentation made a positive impact on the judges and helped Quique later, during the contest. By the end of the day, the top five were fairly well-established, with Jason Shulman being a possible threat for fifth.

DAY THREE

This was the final qualifying day. During the known sequence of maneuvers, Gene Rodgers folded a wing and lost his ship. Geoff Combs still had radio problems but reluctantly completed all the rounds. Chris Paysant-Le Roux won the known sequence and was obviously getting stronger as the contest continued. The amazing thing about this was that Chris's ship was not large enough to receive a bonus score (see sidebar).

Steve Stricker won the unknown sequence with an outstanding display of beautifully drawn geometric designs—a pattern that he had never before flown. Many are convinced that no other pilot in the world can make a marginally powered airplane perform like Steve does. In 1992 , because of its large size, his Ultimate was perceived to have effectively about 25 percent less power than the rest of the field. Steve made it fly as if it had as much power as any other one.

This year, Steve again proved that he's the master of marginal power by showing crisp, clean vertical lines after snaps and maintaining heading no matter what his 49-pound 300S wanted to do.

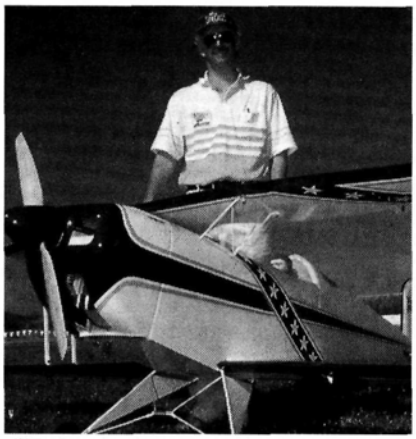
At the end of the day, Quique Somenzini was first to qualify, and he was followed by Chip Hyde, Steve Stricker, Chris Paysant-Le Roux and Dave Von Linsowe. Jason Shulman (a name to watch) did an excellent job in his first TOC, finishing sixth and not far from making the finals.

THE FINALS

As the sun broke over the mountains of the Nevada desert, I looked out through my hotel window at dawn and tried to imagine what the finalists were feeling. After months of preparation and three days of intense competition, it was time to face the scrutiny of the judges, the other competitors and the week's largest group of spectators—a highly charged situation. Remember that the pilots take into the finals only the intangible impression that they've made on the judges; apart from that, it's like a brand-new contest, and anything can happen.

During the finals, Steve Stricker won both known sequences with Quique Somenzini dominating the unknown and freestyle sequences. Chip Hyde had respectable unknown sequences, but he lost his motor during a sorely needed known sequence. Everyone has a bad day and this seemed to be the case for Chip in the finals.

Chris Paysant-Le Roux flew consistently well, and Dave Von Linsowe was more hot and cold. Some of the pilots told me that Quique was doing tumbles instead of snaps



"Model Airplane News" columnist Dave Patrick and his Bucker Jungmann during the prelims.

This is the ½-scale Laser presented to Bill Bennett in gratitude for all his years of support to the TOC. This ship was built by a crew of great modelers, including Bob Noll and Frank Knoll.

TOC format

To give you a better understanding of the demands made of the TOC pilots, let's examine the format used to score the flights. As in '92, this TOC used three elements to judge a pilot's ability:

- **Known Sequences**—two different maneuver schedules that are given to all competitors about a year before the contest. In '94, it accounted for 30 percent of the total score (40 percent in 1992).

- **Unknown Sequences**—given to the pilots each evening to be flown on the following day *without* practice. The five pilots in the finals had to fly two unknown schedules that would account for 50 percent of their scores (40 percent in '92).

- **Freestyle**—where the pilots show their stuff! With 20 percent of the score on the line, the pilots perform an original 3-minute routine. Most had smoke systems and used music to enhance their presentations.

To summarize the preceding, during the qualifying rounds, every pilot flew the known sequences twice, three unknown sequences and two freestyle sequences. They then dropped the flight with the lowest score from each pattern flown. The scores from the remaining flights were totaled to determine the top five finishers.

In the finals, each pilot flew two known sequences, two unknown sequences and two freestyle sequences; the best score in each was kept. It's important to understand that no scores were carried over from the preliminary rounds to the finals, which was like a new contest.

During the awards banquet, to show gratitude for his efforts, Bill Bennett was presented with a ½-scale Laser built by Frank Knoll, Bob Noll and several others.

during his sequences, but his winning margin was so great that it probably would not have mattered. At Sunday's end, Quique fulfilled a dream by winning the 1994 TOC.

Of the five finalists, Chris Paysant-Le Roux was the only pilot who didn't receive a bonus because of the size of his aircraft. If he had flown a larger aircraft and scored just

Steve Stricker and mechanic Kelly Jacobson "pre-fly" an unknown sequence using a small mock-up Extra 300S. This is how most of the pilots gain orientation before actually flying an unknown sequence.

as well, he would have bumped Steve Stricker from second to third. It wouldn't have been as close if Stricker had scored better on his freestyle sequences. Hint! Hint! But these pilots are the cream of the crop and put on a fine display of aerobatics. At the end of the contest, accompanied by Miss TOC, Debbie Ellis, Steve Rojecki presented trophies and checks to all the finalists.

CONCLUSION

The Tournament of Champions owes its spectacular success to the sponsorship of Circus Circus Enterprises and to Bill Bennett's participation. The event is the pinnacle of R/C aerobatics competition, and all who have participated are extremely grateful to Bill. During the awards banquet, to show gratitude for his efforts, Bill Bennett was presented with a ½-scale Laser built by Frank Knoll, Bob Noll and several others. It was a very special moment. Hope to see you at the 1996 TOC!

**Addresses are listed alphabetically in the Index of Manufacturers on page 131.* ■

An exclusive profile of a leading racing engine m

Henry Nelson

by DAVE GIERKE

Editor's note: no discussion of pylon racing would be complete without a mention of Henry Nelson. His company, Nelson Competition Engines, has produced some of the most successful engines ever used in competition. Nelson's Formula One and Quickie engines set industry standards for manufacturing quality and performance, and they've won many national and international championships, including the most recent FAI Pylon World Championship.*

Famed racing-engine designer Henry Nelson (left) and national and international pylon-racing champ Dave Shadel. Nelson has produced some of the most successful competition engines in the world.

AT FIRST, I hesitated when Tom Atwood offered me the assignment of interviewing Henry Nelson. Rumor suggested that he's difficult to talk to. There are several interesting theories why: he feels uncomfortable without a tachometer in his hand, or a calculator on his belt; sometimes, he seems far off, deep in thought...probably working on a mental exercise, such as calculating how much exhaust-port area is required at 25,000rpm; or maybe it's as his car bumper sticker says, "I'd rather be honing cylinders"!

Seriously, I didn't hesitate; I eagerly accepted the challenge. And challenge it was, because no one I talked with seemed really to know much about him. At the '92 Nationals, I spoke briefly with him concerning the Quickie 500 (Q-40) test that I was about to conduct for my first "RPM" column. He impressed me then as he had 20 years earlier—a quiet, unassuming person who really understands the workings of high-performance miniature engines.

In 1972, I was busy flying R/C pylon racing. Several years earlier, I "retired" from stunt, but I was still interested in many of the control-line events. I recall wandering over to the team race practice circle, watching a new guy fly his model. The new guy was Henry Nelson, and his equipment was fast and reliable.

As the pitman, his job was starting, launching, catching, refueling and restarting the engine. Occasionally, he would adjust the needle valve or the diesel's compression screw to get it "just right." His reputation was already establishing him as an engine man who had "the touch." He also did all his own machine work, including the tricky chroming of the cylinder.

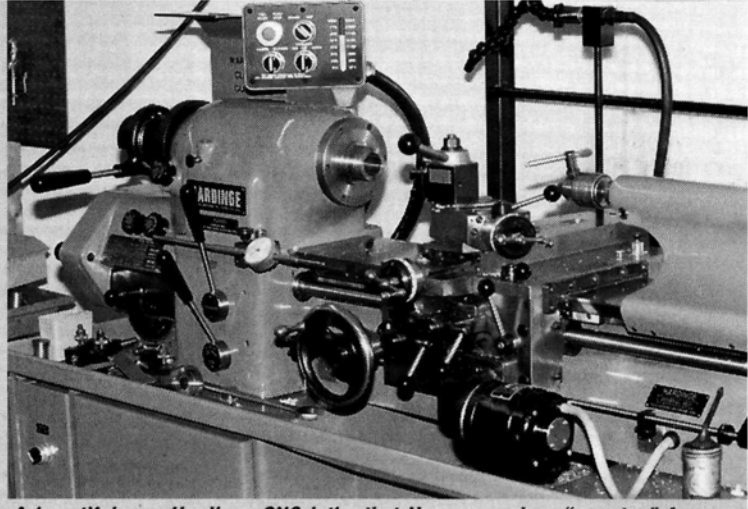
That was all I knew about him. I needed to do some homework. I couldn't help but wonder where my research might lead me. Who was this mysterious fellow? What was his background? And most of all, why has he been so successful where others have failed?

Several weeks later, I made arrangements to visit the Nelson Competition Engines manufacturing facility in the hills of western Pennsylvania. My wife, Carolyn, and I made the leisurely trip down the New York State throughway from our suburban Buffalo home to Erie, PA, then south on Route 79, until we exited at Zelienople, about 20 miles outside of Pittsburgh. A drive of about 10 minutes more put us at our destination—total travel time 4½ hours.

What a picture-postcard setting! From the road, we looked across a valley to a gleaming white 2½-story colonial house surrounded by majestic 75-foot pines. Henry, his wife, Kathy, and their daughter, Annie, live there. To the right of the house and about 250 feet back was a single-story, 80x40-foot, barn-like structure sided with corrugated steel and painted red with a gable roof. It looked like a place where fine show horses would be stabled. In reality, thoroughbreds of another sport reside here. The meadows surrounding the complex are neatly fenced and meticulously maintained.

As we drove up, the only clues that something might be going on were the four compact cars parked outside. On entering, we were greeted by a smiling Henry Nelson who was working at his desk. His office

ufacturer



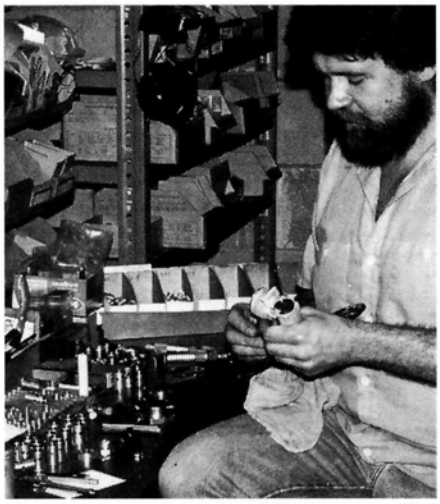
A beautiful new Hardinge CNC lathe that Henry says is a "new toy" for producing prototype engine parts.

consists of several desks, a large drawing table, a personal computer and dozens of engineering reference books. Stacks of other materials, including model magazines, correspondence, engines, parts, wax models of crankcases and a collection of Annie's toys filled the room. Of course, there was the telephone—Henry's link to the world of competition model aviation—and until he took it off the hook, there was a steady succession of calls. Henry apologized for the casual state of his office (in his words: "messy"). I thought it represented a realistic working environment for a very busy entrepreneur.

After some introductions, we toured the machine-shop part of the building. I was startled by what I saw. The place is filled with state-of-the-art, computer-controlled machines! Two operators expertly guided them through procedures that were turning out a variety of engine parts. Since photographs were required for our coverage, the next half hour was devoted to that. Meanwhile, Henry again expressed his concern about the "messy conditions." He didn't want to give our readers the impression that his facility is in chaos. I assured him that what I saw represented the real conditions of engine production. The Nelson shop was clean and neat. Everything had its place, including the buckets of metal chips that awaited the recycler. At the end of the working day, everyone took the time to clean the machinery and sweep the floor.

Nelson's employees don't work a conventional week—a change that many of us would welcome! The exception is Gary Gau, who sometimes works additional periods to de-burr and clean parts, and to repair, assemble and test-run engines for rush jobs. That week, his work included a number of repairs and assemblies for competitors who planned to race in the first contest of the season. Nelson knows the special needs of his competition-minded customers, and he does everything he can to accommodate them. After all, from his own years of top national and international competition, he knows what it takes to win.

To illustrate this: Henry Nelson is the only person I know who has his own team race flying site—a poured-concrete, 10-foot-wide track, in doughnut shape, with a radius of approximately 50 feet. Since there isn't any flat ground on his property, Nelson had to hire heavy machinery to move the side of a hill out of the way! But team racing hasn't been flown much lately, there's just too much work to be done with the engine business.



PHOTOS BY DAVE GIERKE

Gary Gau performs one of the few non-CNC operations on a minor component.

Henry Nelson started to build and fly model airplanes in about 1958. Always interested in control-line, he specialized in combat and stunt with a little balloon-bust thrown in. Having grown up in the Seattle, WA, area, there was also some free-flight activity in his background. Henry began to compete almost immediately, honing his skills for more than a decade before getting serious about the international (FAI) control-line team racing event. During this time, Henry attended the University of Washington, where he received a degree in mechanical engineering. His first job was with Boeing; then he moved east and worked on nuclear reactors for Westinghouse—including mechanical design of internal parts of reactors for Navy submarines and destroyers.

Henry was a member of the 1974 USA team in Czechoslovakia, where he wasn't pleased with "a middle-of-the-pack" finish. Nevertheless, he continued to pursue excellence in this event through 1980, primarily by developing a superior engine. We pick up our interview by asking him to detail some of his early engine development work:

Model Airplane News: *One of your early team race diesels was a modification of the K&B .15. Can you tell our readers something about this engine?*

HN: Well, it was the only Schnuerle-ported engine available at the time. This was K&B's version of the ARM diesel, which was Roger Theobald's design. The only thing I had to do was make a head and a chrome cylinder liner.

MAN: *Did you have any association with K&B and the Brodbecks during these developmental times?*

HN: No, but when I returned from the World Championships, I made a bar-stock crankcase while using a K&B piston, crank and rear cover. When I made the first cast crankcase for the Nelson, I bought the remaining stock of assembled engines from K&B.

MAN: *Your first Nelson team race diesel—a .15ci—was one of the first to incorporate a rear exhaust. Would you elaborate on this design?*

HN: In 1975, I went with a rear exhaust so I could use a megaphone [an exhaust extractor

pipe], but this didn't work out. People criticized the rear-exhaust setup. They said cooling wasn't good enough at the rear of the cylinder. We proved that to be wrong.

MAN: *How and why did you progress from competition team racing to the role of engine manufacturer?*

HN: Anyone who builds things thinks, "I can make a living at this." In May, before the World Champs, I asked Westinghouse, my employer, for a leave of absence. They said "No." They felt that model airplanes didn't qualify as a reason for a leave of absence, so I quit. After returning from Czechoslovakia, since I didn't have a job, I decided to try this for a while. I went ahead with the bar-stock work, trying to develop an engine. It turned into the team race diesel.

MAN: *Did European engine design play a major role in influencing your designs, or did American designers, such as Bill Wisniewski, Roger Theobald, Luke Roy, Carl Dodge and others attract your attention more?*

HN: The K&B was Roger Theobald and Wisniewski's work. I added bigger boost ports in '74 to '75. The basic work of putting the package together was done in collaboration with Carl Dodge. Development of that engine and how to fixture things was Carl's doing. [Dodge is also a mechanical engineer, and he won the World Championship in FAI speed in 1990.] I became acquainted with Carl in the early '70s at the FAI team trials when he flew team race. He never took it too seriously; however, his main event has always been speed. I was influenced by American experimenters, but there really is no originality.

MAN: *Most of today's sophisticated 2-stroke engines can be traced to breakthroughs of the past 40 years. Such technical items as Schnuerle transfer porting, disk and drum induction valves, special piston and cylinder materials such as ABC, AAC, etc., along with new alloys and manufacturing techniques all contributed to the state of the art. As an engine designer/manufacturer at the cutting edge of technology, what do you feel is your greatest attribute or asset in advancing this state of the art? Manager?*

HN: Well, I'm not a particularly good manager. Until the past five or six years, I ran the equipment and did most of the work myself. I'm a good enough, self-taught machinist to be able to manufacture my ideas, but it's the ability to do all of the required things. Now, my main jobs here are: I talk on the phone; I do the honing on the sleeves—sleeve shape and finishing is my exclusive responsibility; and I make decisions out in the shop.

MAN: *The late Paul Bugl—the Austrian genius of world-caliber engines in the 1960s and '70s—was a legend among those who knew him. He was obsessed with designing and building engines. He was the only person working on Bugl engines before he died, because he didn't trust anyone else to do the work—a one-man operation from start to finish. He built all the pieces, repaired them and even flew them in competition. It has been said that you have taken over where Bugl left off. How do you react to that?*

HN: I don't think that I'm nearly the compulsive perfectionist that he was, and I'm probably not as inventive. Undoubtedly, I'll offend the lovers of Paul Bugl, but even though the Bugl engine was constructed like a superb watch, it was a miserable design that ran despite itself. Some of the most inventive features of the engine were, in hindsight, wrong. This is why, when the good fliers started using my engine after 1977, they could go faster with more reliability than with the Bugl, even though the engine itself wasn't made as well.

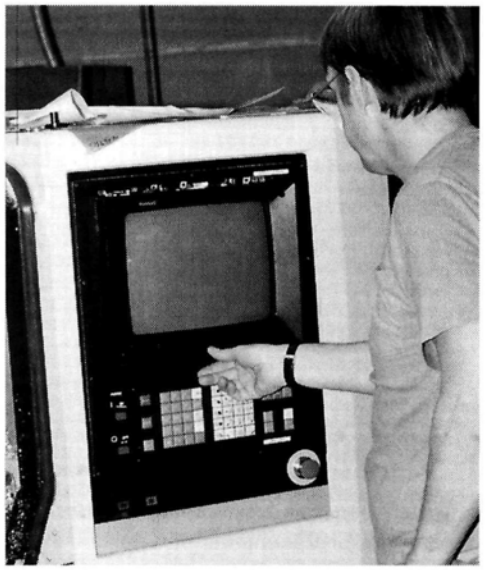
MAN: *Moving along to the present. How much of the work do you job out?*

HN: We make the crankcase molds and send them out for casting, and that's about it. We get needles made, and we don't make the glow plugs.

MAN: *Where do you send the molds?*

HN: To Missouri, Connecticut, New Hampshire and Minnesota, because of competitive bidding and who can do the job.

A bin full of rear covers/radial mounts for the Quickie .40 engine.



Henry Nelson programs one of the CNC units in preparation for boring a crankcase.

MAN: *What process is used for the crankcases?*

HN: The lost-wax method. This is also known as "investment casting"; they're expensive—about 10 times more than die casting.

MAN: *How much of your operation depends on computer-aided machining?*

HN: Probably about 90 percent; virtually every part has its major operations performed on a CNC machine.

MAN: *How do you find time for research and new product development? If you could choose, what percentage of your time would you devote to these things?*

HN: It's difficult; there's never enough time. I'm not even sure what the percentage is; it's not enough.

MAN: *Do you do your R&D after hours?*

HN: During the day—in lieu of doing something else. The help works 10-hour days, four days a week. I work seven days a week; that's one reason why I don't compete anymore—there's no break. You can work hard on a hobby when it's different from your job, but now it all feels the same. You hope you enjoy your job better, but you've lost your hobby.

MAN: *If you could, would you spend your whole time on R&D?*

You can work hard on a hobby when it's different from your job, but now it all feels the same. You hope you enjoy your job better, but you've lost your hobby.

HN: No, the whole business is of interest, not just R&D.

MAN: *After a hard day's work, how do you unwind?*

HN: I read. I'm interested in history in general, but the technical history of just about everything; modern warfare is very technical. I'm interested in that as well as the airplane, of course.

MAN: *Is there any difference between the product that Nelson produces and the product that Dave Shadel and Performance Specialties* markets?*

HN: I don't think so. The parts are put together the same.

MAN: *Does Dave assemble the engines that he markets?*

HN: He does the cleaning, the assembly—everything.

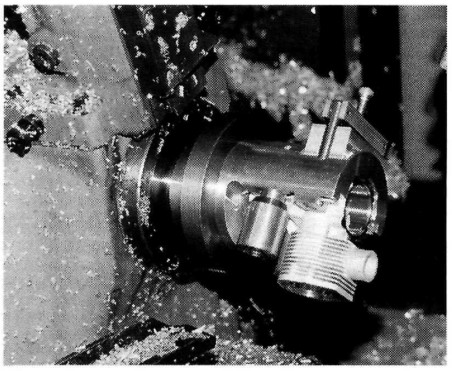
MAN: *Your current line of competition engines is considered by many to be the finest in the world. Along with this performance level comes a high price for your customers. Could you spend a moment listing a few of the reasons why your engines are priced the way they are?*

HN: Well, first of all, they are generally lower production numbers. Anything you're going to compare it with is higher production and, sometimes, cheaper labor. In some cases, we use more expensive components—investment casting we've already talked about. The CNC equipment we use is versatile, but it's slower to operate than single-purpose machinery, which could be used for running far more parts. We use more hand labor. We don't see how you can reach the level of quality that we try to put in without using hand labor. We also test-run all the engines extensively; most manufacturers don't run them at all. All the items mentioned are part of the total package and are reflected in the price.

MAN: *What would a typical batch size be for one of your engines?*

HN: It depends. For the smaller production engines we aim for about 100 pieces.

MAN: *And that could be expanded to several hundred for the popular Q-40s?*



Note the crankcase holding fixture used for a boring operation on a CNC machine.

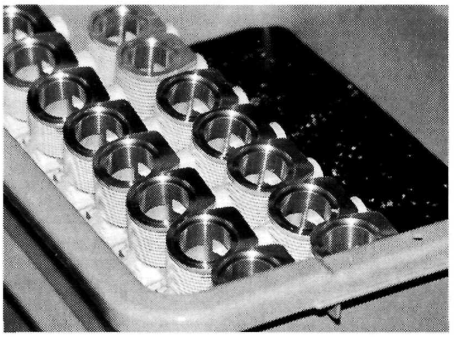
HN: Yes, but we never do thousands.

MAN: *Trying to keep up with the parts must be a real problem.*

HN: It is; we make too many different things. It's the market that dictates how many we sell.

MAN: *Your engines are currently directed at the competition modeler. Do you foresee a time when the general modeling public will see engines directed toward them?*

HN: No, because they won't pay for the small performance increase realized by these engines. We've sold a surprising number of Q-40s with Perry carburetors to people who just want to get out and go fast at their local field, but that's still a small segment of the market.



A bin containing partially machined Quickie .40 crankcases.

MAN: *Last year, you provided Bob Violett Models [BVM] with a .91ci ducted-fan engine. You provide the components, and BVM assembles and sells them as part of their exclusive power-system package. How do you find the time to do all these diverse engine-related activities?*

HN: It's just part of the job. It's done when we're not doing something else; we fit everything in.

MAN: *How much input did Bob Violett offer on the design of this engine?*

HN: The engine had to fit the existing power unit. Much of the external dimensions were dictated by the .81 or the earlier .72. We intended to use many of the existing KBV parts, and that dictated the size. We could have made a few more changes if we had started with a cleaner sheet of paper.

MAN: *Can you point to someone who has been a special asset to the development of your career?*

A bin full of partially machined high-silicon aluminum pistons.

HN: [after some thought] Back in Seattle, when I was a kid, a man named Dick Love taught me the most about modeling. He was an engineer and was probably responsible for getting me into the career of engineering. He was the biggest influence in getting me started.

If you're interested in researching Henry Nelson's early team race years, you'll find the references listed below useful. In my research for this interview, I must thank Mr. Al Baker and Mr. Ken Parent —two long-time team race competitors from Canada—for taking the time to talk with me about team race in the mid-'70s.

References:

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**Addresses are listed alphabetically in the Index of Manufacturers on page 131.* ■

GOLDEN AGE

HAL DeBOLT

OT R/C MAILBAG

The smaller Cavalier 60 at Hadley Field—remember?

PERHAPS YOU REmember my telling you of a young modeler's visit to the Harris Hill (Elmira, NY) glider port to see the R/C gliders of Clinton DeSoto and Russ Hull? Gary Fogel of Los Angeles, CA, says that the gliders flew demo flights; but I had forgotten that the event was the finals of the National Soaring Championship. Gary is the Torrey Pines Gulls R/C Soaring Society's historian and is searching for info about early R/C at that fine facility. He would appreciate any help you can offer; write to him at 9715 Charnock Ave., #202, Los Angeles, CA 90034.

CHAMP CONSTRUCTION QUERY

Bruce Cronkite of San Diego, CA, asks for information about the LW Champion because he wants to duplicate it accurately. He particularly asks about the position of the stabilizer. His original kit-box label shows the stabilizer on the bottom of the fuselage (like those of the previous LW Trainer and Cruiser). But the drawing he has shows the stab mounted higher, more as we mount it today. How come?

First, remember that the design was in production for over 30 years and that the structure was "updated" periodically; its design reveals in which era a particular kit was produced. But none of the "kitted" Champions used a bottom-mounted stab; for expediency, the kit's photo was of the prototype Champ, which differed from the kit version. In those early days, we flew off bumpy fields—no pavement or manicured grass—and many complained that the low stabilizer tended to drag in tall grass. So the kit version had been modified to address this problem. We were learning!

I also heard from Bill Effinger of Berkeley fame (you perhaps know him now as owner of W.E. Technical Services). Bill took note of my mention of the Custom Cavalier, which was a common sight in early R/C days. Bill says that when they kitted Ben Shereshaw's design, they incorporated some obviously necessary changes: the dihedral was reduced, and the fuselage cross-section was made oval instead of circular. Even more important was the change in covering; Ben had covered that extensive fuselage with sheeting—a major chore! The kit used $\frac{1}{8}$x$\frac{3}{8}$-inch planking. How well I remember

OT R/C ORGANIZATION ACTIVITY

Each year, our two OT R/C organizations—Vintage R/C Society (VR/CS) and Senior Pattern Association (SPA)—both conduct major events. With the VR/CS, it's Selinsgrove, and with the SPA, it's the Masters at Smyrna, GA (SPA home base).

Chief honcho Mickey Walker reports that '94 SPA activity was very enjoyable; several outstanding meets throughout the Southeast were capped by the Masters in September. Mickey and his associates have brought the SPA along in fine style there, but he wonders why the rest of the country hasn't appreciated what the organization has to offer. Perhaps the rest simply don't know what an enjoyable way to compete the SPA offers. Could be that lack of knowledge is to blame. Want info? Write to 3121 Northview Place, Smyrna, GA 30080.

Tom Atkins is happy with the Masters Grand Champion award.

The concept is simple: meets are pattern competitions for designs and engines produced before 1970 according to the rules of that era. As the photos indicate, lots of great models came out of that time! Additionally, the entrants are divided into five age groups, so there's a place for everyone!

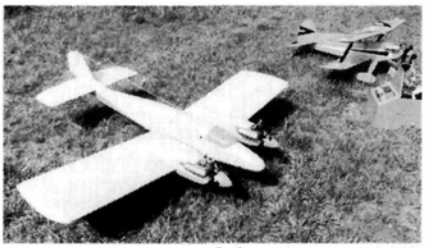
For a change, the '94 Masters enjoyed two days of almost perfect weather; more than 40 entrants flew up a storm, and everyone enjoyed the first-class organization and the fine "eats."

I'll let the photos tell the story, but here are the class winners: Pre-

An OK twin-powered Custom Cavalier on takeoff.

the gigantic bundle of planking strips in my kit!

Bill also tells us that he and Tracy Petrides built the first "stick-type" gas model as well as one with an *all-plywood* fuselage. (Is nothing ever really new?) He goes on to say that Berkeley cured the ambiguous RK-61 tube problem by switching to a British "Hyvac" tube, which they ionized in a tesla coil to improve performance and life. Does anyone recall those high jinks?



Rodney Riker's twin O.S. .40-powered LW Viscount is just as spectacular as the original was in 1962.

The activities of Rodney Riker of Longmeadow, MA, bring back memories. Back in 1962, when propo arrived and we had gained confidence, I thought that using twin power would offer a way to increase the power loading without increasing flying weight. Visualize two .35s at 14 ounces (combined) compared with one .60 at 15 ounces; the thrust of a .70 plus two-prop efficiency! To test the concept, a LW Viscount was modified to accept the two .35s, so the plane's normal .40 power was nearly doubled! (*Model Airplane News* published the plans in 1963.)

From its first takeoff, the plane was astounding! For the first time, we had a pattern design that would fly vertically until it was out of sight. We thought we had it made, but the unreliable throttle control of those days soon brought out the shortcomings of the one-engine-out syndrome. As a novelty, the twin Viscount was great, but it wasn't dependable enough for competition use.

Rodney says that, in 1963, his interest

SAD NEWS

It's always hard to pass on news such as this, but Bill Winter—definitely the "granddaddy" of R/C—recently lost his wife, Sylvia, after a long illness. As well as being the mother of their nine children, this unassuming, gentle lady was Bill's right arm, and I'm sure you'll all join me in sending condolences.

Now in his 80s, Bill is still hard at it investigating new and always ingenious ways to fly R/C; in fact, he's probably more active than most. A modest man, when we credited him with much assistance with our first LW project, he immediately said: "You gave me far too much credit." But without his everlasting patience and amazing knowledge, the result might have been very different! We extend to him our deepest sympathies.

Masters CD Mickey Walker and the event's fine awards.

Senior Novice—Scott McGowin; Senior Novice—Ron Reed; Super-Senior Novice—Lyle Sams; Super-Senior Master—Ed Hartley; Senior Master—Bruce Underwood; Grand Champion—Tom Atkins.

Mickey closed by saying that all agreed the event is great stuff; make it a date for this year!

Taken at the '94 SPA Masters, this photo shows a few of the wide variety of excellent pattern designs that fit this activity. Left to right: Kirkland Citron, Bridi Chaos, Whitley Daddy Rabbit, Tanglefoot, New Orleanean, A-6 Intruder and, in front, a Lanier Pursuit. Pilots (left to right): Chuck Sanders, Jim Rogers, Ed Hartley, Tom Atkins, Dan Lacey, Mickey Walker, Keith Watson and Ron Van Putte.

in a twin led him to the *Model Airplane News* plan. He soon had the twin ready for covering (it was relatively simple to modify the Viscount kit), but it was '92 before he was able to complete it (OT'ers never quit!). By then, after a break from the hobby, he was enjoying modern R/C systems and engines, and the stored twin was quite a temptation; Rodney kitted it out with his Futaba radio and two O.S. .40s.

From its first uneventful flight, his Tobacco Valley Fliers club members were in awe of the twin's performance. Having already logged many flights, he has rarely encountered the "twin syndrome"; cutting the remaining engine has always been a viable solution. How time has improved things! For the most part, the plane is flown with those potent .40s at half-throttle, but even so, its spectacular performance and sound are always attention-getters. It's always great to hear from someone who has found another way to R/C fun!

RAY REMINISCES

Ray Armstrong of Castro Valley, CA, enjoys this column so much that he cuts it out of every issue and files it; he also says that he enjoys the rest of the mag. A while back, I mentioned Jim Simpson and his exploits with F&M propo systems. Ray wonders whether this Jim Simpson is the helpful modeler who guided him through his first R/C activities and introduced him to "parachute silk and dope" for covering. He still has his first single-channel system—one that Jim set up for him on 27.255mHz—and he asks if he could fly it on that frequency today. We do hear of flying on the 27mHz band (apparently, CB activity has diminished considerably so it's a viable frequency). Can anyone shed light on this topic?

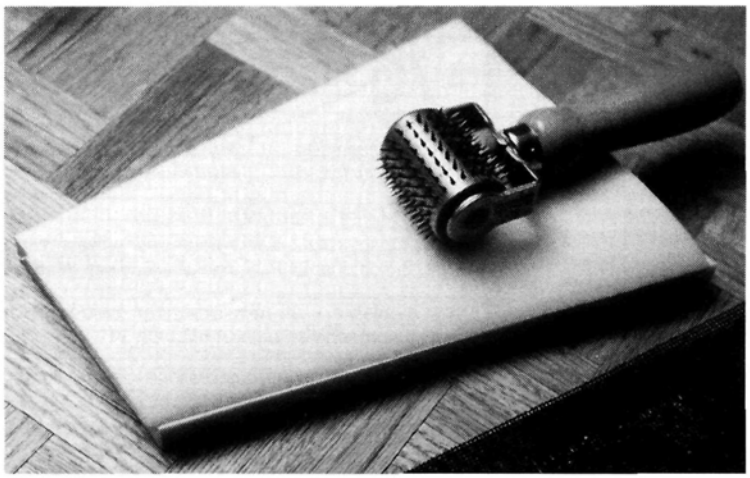
Finally, remember that this is your OT R/C place, but you have to provide the input for us all to enjoy! ■

CENTER ON LIFT

MICHAEL LACHOWSKI

FOAMS AND PROGRAMS

MOST OF THIS month's column is dedicated to looking at one of the primary materials that's used for sailplane wings—foam. I also want to tell you about two of the tools that I use to help prepare the core before sheeting or bagging. For the computer enthusiasts out there, I have an update on the PC-Soar program, which lets you compare the performances of sailplanes. Remember to go flying, though, and don't spend too much time on your computer.



A needle roller does an excellent job of preparing a smooth hot-wire surface of some extruded foams before sheeting.

BUILDING WITH POLYSTYRENE FOAMS

Wood sheeting over foam-cores is the standard construction technique for sailplane wings. For stronger wings, composite skins made of fiberglass, carbon fiber, or Kevlar are used instead of wood. In the high-tech-molded arena, a sandwich is made from a lay-up of cloths and foam inside a mold that forms a hollow shell. I want to talk about the different foams and the advantages of each type.

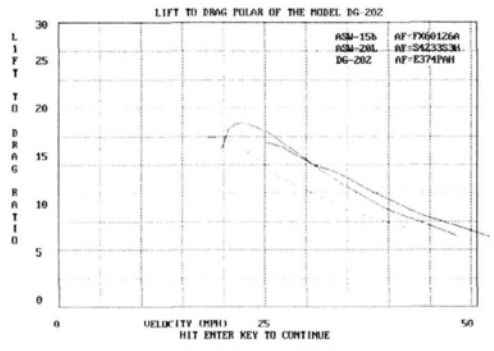
The first thing we must understand is how to measure or characterize the foams. The first property is density; how much does all this foam weigh? Generally, the measurement is in pounds per cubic foot. We also need to consider how crush-resistant the foam is.

Expanded-bead foams and extruded foams made of polystyrene are the most common. The bead foam is made of beads of plastic that have been pressed together, leaving air gaps between the beads. Most of these foams are white. For those who are interested in being colorful, the extruded foams—made of closed cells with air evenly distributed throughout—are available in blue, gray, green and pink, depending on the source. The advantage of polystyrene foams is the ease with which they can be cut using a hot wire. It's easy to make your own hot-wire bow, or you can use a commercial product such as Tekoa's* Feather Cut (reviewed in the July '93 issue of *Model Airplane News*). Polystyrene foam is commonly used for insulation and can be found in lumberyards.

HOW HEAVY?

Bead foams come in a variety of densities and qualities. You want to be sure that you have virgin—not recycled—foam. Recycled foam is inconsistent in density and strength and may have some debris in it that will catch the hot wire while it's cutting. I've used foams rang-

PC-SOAR 3.5 UPDATE



Lift-to-drive polar graph.

Lee Murray has updated PC-Soar—a program that allows you to compare the performances of sailplanes. The program uses wind-tunnel data and a description of the model to predict its performance. The description contains 29 parameters, including wingspan, wing area, weight, fuselage dimensions and airfoils. It crunches this data to predict flight-performance figures such as maximum L/D, minimum sink rate and flight stability. PC-Soar is a DOS program, and it doesn't require Windows or a fast processor.

Version 3.5 updates the program so that it's compatible with the latest versions of DOS and has automated program installation; it also fixes a few program bugs. The documentation has also been revised and includes an index. Upgrade prices are: $10 for PC-Soar and its libraries; $30 if you want documentation and don't have the sailplane and airfoil libraries. Be sure to include another

ing from ¾ to 2 pounds per cubic foot. Using lighter foam may actually save you up to 4 ounces in a 120-inch wing.

Most models call for foams that weigh about 1½ pounds per cubic foot. If you want to try lighter foam, be sure that the structure doesn't depend on the foam to prevent the spars or carbon fiber from buckling. The really light foam is not strong enough to act as a shear web. It will also become crushed and distorted if you use much more than 7 inches hg as measured by a vacuum pump.

The consistent texture of extruded foam makes it easier to sand and carve than bead foam. This is the type of foam most builders prefer when vacuum-bagging cloth skins. Again, densities vary. Pink Foamular 150 and Dow Grayboard are on the light end, while the blue Dow Styrofoam and Dow PRB (Plaster-Ready Board) are heavier. The lighter foams are hard to find in cold climates because they usually have lower insulation (R) values. On the East Coast, you usually have to go below the Mason-Dixon line to get the gray foam. Hmm... Blue? Gray?

The bead and extruded foams fail somewhat differently and require different repair methods. The white foam is usually easier to fix because the foam in the damaged area breaks out and gets only slightly crushed. You can glue this back into place and just add a little filler. The extruded foams tend to be crushed and to crumble, so it's best to cut out the damaged area cleanly and fit a new piece in. Fortunately, it's easy to work this type of foam with a knife and sandpaper. In fact, if you have to fill a damaged area on a white-foam wing, you might consider using extruded foam.

WORKING WITH FOAM

Hot-wire cutting leaves fuzz on the surface of the foam-core. You have to remove this to get a good bond between the foam and the skin. Some people use tape or sandpaper, but the best method is to sand with drywall sanding screen. The sanding screen looks like screen that has an abrasive bonded to it. The open mesh helps to remove fuzz from the surface. If you use regular sandpaper, the fuzz will sometimes build up on it and damage the foam while you're sanding.

Extruded foam may have a fairly smooth surface that needs just a little modifying to improve its bond to the skin. You can do this by beating the wing with a wire dog brush (the wing, not the dog). Or you can get a needle roller—a roller that's covered with needles—from Composite Structures Technology*. Don't forget to do a good job removing all the dust and fuzz before you skin your wing.

The biggest problem with polystyrene foams is gluing them. Most solvents will quickly melt the foam. Be sure you use odorless CA, epoxy, or a water-based glue. Most spray paints and polyester resin will give you a melted mess. I usually carry odorless CA for field repairs; it's more expensive, but it can be used safely on foam.

WHICH IS BETTER—EXTRUDED OR BEAD?

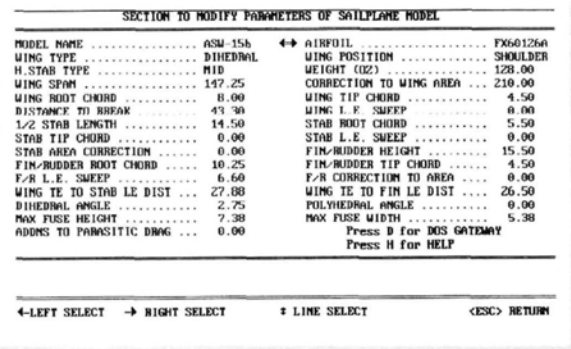
For most applications, the bead foam is a little lighter, and it works well for hot-wire-cut cores when you use wooden skins. Slightly heavier extruded foam is the best choice for vacuum-bagging because it allows you to use a higher vacuum pressure without being crushed. Otherwise, the choice comes down to which one is cheaper at the local lumberyard.

In another article, I'll talk about some of the other foams you can use. Most aren't suitable for hot-wire cutting, but they do offer better compression strength and are resistant to solvents (and they're more expensive).

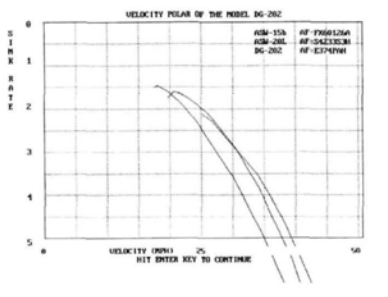
**Addresses are listed alphabetically in the Index of Manufacturers on page 131.* ■

$3 for postage and handling. If you don't have PC-Soar, the program costs $40; and for an extra $15, you can get a great selection of over 200 wind-tunnel and theoretical polars.

PC-Soar is available from LJM Associates, Sailplane Design Products, 1300 Bay Ridge Rd., Appleton, WI 54915; (414) 731-4848.

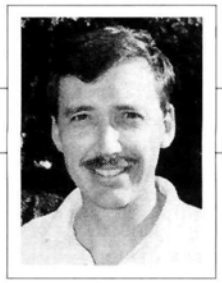


PC-Soar parameters.



Velocity polar graph.

SIMPLE PROGRAMMING



DAVID C. BARON

FUTABA 6VA SKYSPORT

FUTABA'S* latest radio—the SkySport—has an interesting blend of features that mixes modern programmable concepts with traditional analog setup. There are two versions of the radio on the market: one for aircraft (6VA) and one for helicopters (6VH). This month, I will explore the capabilities of the aircraft version.

At first glance, the SkySport appears to be a conventional system without special features, but a closer examination reveals an intriguing variety of functions. The reason that it looks conventional is that Futaba has placed all the function controls under the back panel of the radio. This is smart because, if you're using an advanced function such as differential ailerons, you would not want to accidentally switch the function off and proceed to fly your plane; that could be disastrous.

Futaba's new SkySport radio—available in both aircraft and helicopter versions—offers a combination of programmable concepts and traditional analog setup.

WHAT THE SKYSPORT HAS TO OFFER

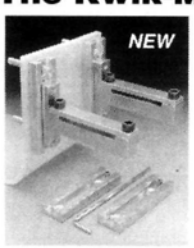
• **Differential ailerons.** In many applications, differential is used to accomplish turns that do not induce any adverse yaw or cause the plane to skid in the wrong direction when entering a simple aileron turn. In essence, differential lets your model turn in a more coordinated manner. It requires separate aileron servos that must be plugged into channels 1 and 6. When it's on, differential allows you to manipulate the ratio of upward aileron throw in relation to downward throw. To achieve coordinated turns, most aircraft require more upward throw than downward throw. I like to use aileron differential instead of aileron/rudder mixing because rudder mixing causes different effects at different air speeds. Also, when the ailerons have more upward than downward movement, there's less chance of initiating a stall at lower air speeds, which could lead to unexpected spins.

• **Flaperons.** This feature is a byproduct of differential mixing. When you use separate servos for each aileron, the flaperon feature allows aileron function throughout the range of flap settings. When the flaps are down, you will notice that the ailerons still function, although, at some point, you may run out of downward aileron throw. This is due to the mechanical limits of the servo and is really not a problem. In fact, this can be a safety feature: when your flaps are fully deployed and the model is flying slowly, an aileron input will lower the flap farther on one side while it raises the other side. This will induce more drag on one side of the plane while reducing it on the other. If your airplane is anywhere near its stall speed, this could initiate a disaster. So remember, when flaps are fully extended, it's safer to let the ailerons work as spoilers and contribute only upward motion.

• **Elevator/flap mixing.** This function is easy to activate if you use separate aileron servos. Use the same receiver ports (channels 1 and 6) as you do for differential ailerons; both functions can be used at the same time.

To maximize your plane's pitch control, the flaps should go down when the elevator goes up. To look at this another way, when the flaps are down, the wing's angle of attack is increased, and the elevator's angle of attack is decreased when it's raised. As a result, far more leverage is needed to raise the aircraft's nose while lowering the tail! If you've ever seen a fun-fly plane or a U-control model do a 5-foot-diameter loop, chances are the pilot was using elevator/flap coupling. I've found that this feature can greatly improve the quality of loops in planes that are prone to snapping or rolling out of loops; for this reason alone you may

(Continued on page 110)



want to try it. To decide how much throw to use, I would start by setting the flap deflection so that it has only half the throw (measured in degrees) of the elevator.

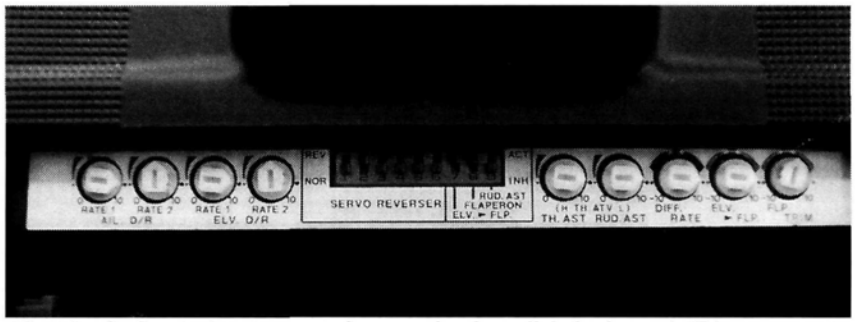
• **ATV (adjustable travel volume).** This feature is available for the throttle. First, however, you must achieve the best possible mechanical setup, and then tailor the extremes of throttle motion for a perfect idle at the low end and the maximum carburetor opening at full throttle.

• **AST (adjustable servo throw).** This feature is available for the rudder and one of the settings and your own experience and instincts to determine the other setting.

The next question that needs to be asked is, should the greater throws be up or down on the switch? Many modelers have excellent reasons why they should use one direction or the other. Futaba has taken a step forward by making it possible for you to set this radio up for either style.

CONCLUSION

The radio is incredibly comfortable to use. I find that ergonomic excellence



All of the SkySport's function controls are under the radio's back panel. This prevents the functions from accidentally being switched off while the radio is in use.

throttle. With the rudder, it allows you to manipulate throws in the same way as the adjustment on the dual rates does (except that there is no switch). If your rudder binds against the sides of the elevator and you have no other way to reduce the overall travel, this could be handy. Again, if you've installed the radio properly, the electronic features will fine-tune it to perfection.

• **Dual rates.** These are common in almost all radios that have more than six channels. They allow you to reduce or expand the throw of the aileron or elevator controls at the flip of a switch. The most common applications include: reducing control sensitivity during training and taming a hyperactive aircraft during a test flight. Both uses require some thought before the first flight. You have the manufacturer's suggested throws for

is quite a goal for manufacturers. The best way to judge how far we've come on this subject is to pick up some of the old transmitters that were mothballed between 1990 and 1991. How long will it be before every one of our fingers is gripping and controlling some function?

This radio is chock-full of great features that are common in computer radios, but the SkySport requires no programming skills. I'm sure it will be well-received by those modelers who are resisting the move to fully programmable radios. There's still a big jump in the Futaba line between this radio and the 7-channel UAPS series, and I hope that, soon, Futaba will introduce an entry-level computer radio.

**Addresses are listed alphabetically in the Index of Manufacturers on page 131.* ■

The whole gang from the Battle of the Aces. This fun-scale, just-for-the-fun-of-it competition took place with help from Pacer Technology, Midwest Products and Frank Tiano Enterprises.

Scale competition for the fun of it!

Battle of the Aces?

by PETE SEPULVEDA

WELL, IT ACTUALLY took place. And it was great fun! I'm talking about the first-ever, limited-scale Battle of the Aces. The original idea for this event was submitted by F-Troop's Frank Tiano, and it was carried out (kept on track) by me (the Commandant of F-Troop) and Tom Guca (the commander of the 1/8 Air Force). The idea was to pit two groups of predominantly military, scale R/C fliers against each other in a really fun flying competition. It worked. Eight members from each group accepted the challenge.

CHALLENGING EVENT

The challenge was to build a fun-scale military aircraft and fly it in a very simple set of maneuvers in the shortest time. The event was co-sponsored by Frank Tiano Enterprises* (FTE), Pacer Technology* and Midwest Products*. Gifts for the pilots were furnished by Hershel Worthy of Pacer Technology. To determine the winner, flight scores were combined with the limited-scale, static scoring system. The 16 aircraft—eight Midwest P-51s and eight Midwest Me-109s—were made available through the goodness of Midwest Products' Eddie Rogala and FTE's Frank Tiano. A big thank-you to both.

FLIGHT REQUIREMENTS

The flight requirements were simple: a takeoff, three loops, a touch-and-go and then land. Sound easy? Each maneuver had to be on the same heading as the takeoff. (I've never seen such short passes in my life!) Times for these flights ranged from 44 seconds to just over 2 minutes. I actually had the best (shortest) flight time, but owing to some ridiculous technicality (I crashed and didn't finish the whole flight), my time wasn't accepted by the other 15 fliers!

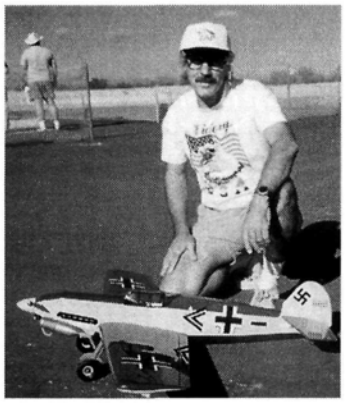
Roy Pratt readies his trusty 109 in the pit area.

The lineup (all Midwest Products models): eight fun-scale P-51 Mustangs and eight Me-109 Messerschmitts.

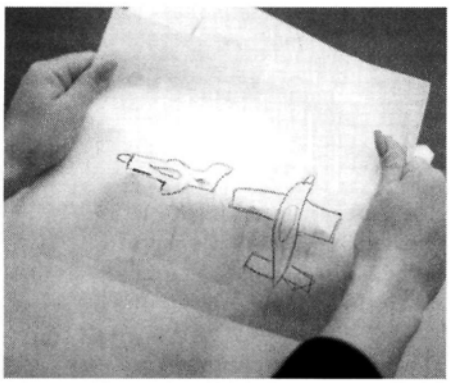
PHOTOS BY PETE SEPULVEDA & FRANK TIANO

Fs AGAINST THE 8ths

The battle was held at the Arizona Radio Control Society (ARCS) field in Sun City, "Azinora" (F-Troop's way of pronouncing Arizona). This meant that the fliers who represented F-Troop had to trek many miles to partake in this great event. Undaunted by this initial challenge, all eight of the required aircraft were present and accounted for. Luckily, we had a ninth volunteer who purchased his own kit and built a backup aircraft, because, as chance would have it, we needed that plane. Members of the 1/8 Air Force managed to complete six of their aircraft, and they got five of them into the air.



Third-place recipient Mike Lappert (F-Troop).



John Lowe's highly unusual scale documentation did little for his static score.

Bob Sortor was unable to finish his aircraft on time because of a serious illness. Tom Guca said his plane fell off the bench and broke. Bill Glover's plane was complete, but "technical difficulties" kept him out of the flying portion of the event on Sunday.

On F-Troop's side, all eight planes made it through static judging, and all but one got in the official timed flight. Chuck Hibbard's Me-109 had technical difficulties; I think it got hurt in his trailer! The F-Troopers all showed up to flight-test their planes on Friday—the day before the 1/8 Air Force Annual Scale Fun-Fly officially began. We held our limited-scale Battle of the Aces with (or in spite of, some might say!) that event.

Seven of the eight F-Troop aircraft successfully flew on Friday. All but one were making their initial flights at this time! I said they were all there; I never said they were all ready (but they were by Saturday). Actually, my 109 had already flown. Unfortunately, it had also crashed (big time), turning the Saito* .50 into a Saito .47. So, with only two left, I bought another kit for parts. F-Trooper Terry Helberg took the demolished fuselage out of my trash can (literally) and rebuilt it for me in two days. Then I used the foam wing I had cut for a future 109 project and quickly got that ready. Bob Cooper (1/8 Air Force) had also crashed his 109 several weeks prior to the event, but bought another one so that he'd be able to compete (that's the spirit!).

HIGH-SPEED GROUND LOOP

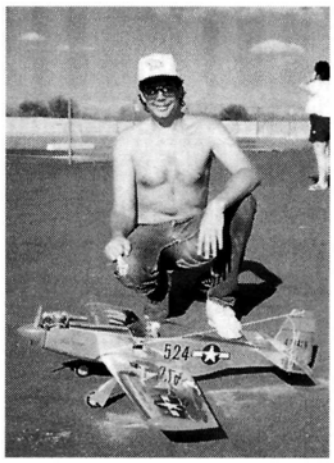
We narrowly avoided a major incident on Friday. Tom Weemes (F-Troop and 1/8 Air Force) had just landed Roy Pratt's 109, and it nosed over about 20 feet off the runway. Because it was way off to the side, I started a takeoff run with my 109; Roy's plane was still nose-up in the dirt. Well, I got squirrelly on my takeoff (what's new) and accidentally "mid-grounded" Roy's 109. It really was an accident, but you'd have a hard time convincing Tom and Roy of that. It looked as if I was about to miss it completely and, at the last moment, I hung a hard left to hit it straight on. Hey, my plane was erratic on the ground; what can I say? Besides, if I planned to take anyone out, I would have aimed for the eventual winner—Lewie Kear! Anyway, neither plane was harmed, and both flew in the competition.

Fifth-place honors went to Bob Frey (1/8 Air Force).

IFR SATURDAY

Ahhh, Saturday; now, that's another story. Friday was sunny, warm and just downright beautiful—exactly what we would expect when we travel for six hours to get to Arizona. Saturday, however, was cold, really wet and, basically, all-around miserable. A lot of socializing took place that day, because the entire event was postponed until Sunday. When we left the motel room on Sunday morning to go to breakfast, it was cold, damp and really ugly looking. A repeat of Saturday? No way; by the time we had arrived at the ARCS's field, the sun was out and the winds had died down! God does fly R/C! Static judging took place early on Sunday morning.

The static judges were Marsha Frey—wife of that famous Jug flier Bob Frey—and Jennifer Tanguy—a member of the Arizona AMA Show Team. Participants were required to provide outlines and color documentation, and some pretty interesting materials were used to support a couple of planes! All participants agreed that the judging, although tough, was fair. One-Eighth's Lewie Kear (P-51) took top static honors, beating F-Troop's Mike Lappert (Me-109) by a single point.



Fourth-place winner Mike Hatfield (1/8 Air Force).

Flying was originally planned to take two days with a head-to-head format—one F-trooper and one 1/8 pilot taking off side by side. But because we only had one day to fly, and it would not have been fair to disrupt the main scale fun-fly event, we decided to let the pilots fly whenever they (and one of the official timers) were ready and could do so without getting in the way of the other fliers.

OFFICIAL FLIGHTS

Mike Hatfield (1/8 Air Force) broke the ice and flew first. He performed his required maneuvers in 46.82 seconds. (The gauntlet had been officially thrown down!) And Mike's time held up until the last two fliers took to the air! Ron Magni (F-Troop) flew his maneuvers in 46.62 seconds, barely edging out Hatfield. But then, on the last complete flight, Lewie Kear (1/8 Air Force) flew a spectacular 44-second flight and took top flight honors to go along with his top static score. So it didn't exactly take a rocket scientist to determine who the overall winner was! The others took a while to sort things out (with me hiding in the bushes) and tally up the rest of the scores.

SQUADRON MARKINGS

The overall quality of the building and flying was fantastic. We only had one duplicate finishing scheme, and that happened when "Crazy" Bob Cooper (⅛ Air Force) and Mike "Fingerless" Lappert (F-Troop) both duplicated the box art for their Me-109s. The 109s offered more radical paint schemes than the P-51s, and F-Troop took advantage of this. A spotted winter scheme (dark green on white) was displayed by Ron Magni. I used a dark brown over tan, spotted scheme on my 109. Jim Pendergrass found documentation for a 109 that had been captured by the Swiss. It was quite striking with red and white stripes and white crosses. Chuck Hibbard produced an all-white 109, and Scott Rais showed up with a P-51 that looked remarkably like a Martin Baker MB-5. His plane was in British markings, and it had a dark green over gray camouflage finish. Three of the four ⅛ P-51s were finished in chrome MonoKote*. Bill Glover chose the box art for his P-51 "Loose Cannon."

Second place went to F-Troop's Ron Magni.

All of the planes had the required three-view and color documentation. John Lowe provided his own documentation, which proved most interesting. It also resulted in the lowest static score! John flew Ellis Chee's P-51; Ellis was unable to make the trip because his stepfather had passed away. (We all missed you, Ellis.) All in all, there were some great-looking aircraft on display. For some reason, the P-51s seemed easier to fly than the 109s, even though the wings were identical.

Best crash? Oh, yeah, that went to me—Pete Sepúlveda.

CONTROL AND HORSEPOWER

The radios used were mostly Airtronics*, with a couple from Futaba* and JR* also present. Among the engines used were my ASP* .40 and Bob Cooper's Saito .80. At least five contestants used the old O.S.* .50 FSR—one of the best engines ever manufactured. Scott Rais had a brand-new Magnum* XL .53 in the Mustang, and it was strong and exceptionally quiet. Jim Pendergrass used a very old O.S. Surpass .40 4-stroke, which seemed to have plenty of power. There were at least two Rossi* .40s, a couple of Super-Tigre* .40s and a .46 (in Lewie Kear's winning Mustang).

First-place winner Lewie Kear from the mighty ⅛ Air Force.

Our contest did nothing to disrupt the ⅛ Air Force's Scale Fun Fly, and I heard no complaints from any of the other fliers. I think we actually kept them all entertained! We had to abort two or three official flights because an aircraft was on landing approach during either a touch-and-go or a landing. But these pilots were allowed an additional official flight. Safety came first all weekend.

Only two planes crashed during the event. My 109 snapped out of my second loop and went straight in just across the runway from the pit area. What a loud sound from such a small airplane (and it's much smaller now!). Jim Pendergrass (F-Troop) lost his 109 when it snapped on his landing approach. He actually cut a few seconds off his overall time by crashing, so we're not sure that he didn't do it on purpose! (His plane was easy to repair.) Steve Alvarado (P-51) had to settle for a high flight time when he aborted a touch-and-go to avoid hitting another plane. We all agreed to let him have another flight, but, on landing, he ripped out a retract and had to settle for the 2-minute flight.

Static judging in action. All agreed that Marsha Frey and Jennifer Tanguy did a great job.

All participants received an Emergen-Z kit from Pacer Technology, and awards were presented to the five top finishers, along with awards for high static, best flight score and absolutely dead last.

The ⅛ Air Force's now-famous Crash Award was given to me for the spectacular and very loud destruction of my little spotted Me-109! F-Troop's equally prestigious Fingers of Death Award almost went to me, but I convinced everyone that it should go to Mike Lappert, who, while preparing for his official flight, stuck his hand through his prop and tore up his thumb and middle finger. I only stuck my thumb in the 3-blade prop on my 109, and that resulted in only a slight gash. This is the first time in five years that F-Troop has earned the Fingers of Death Award. The recipients are usually ⅛ Air Force members.

We had planned to follow the main event with two smaller quests, but Saturday's rain took care of them. It's a shame that we didn't get to see the likes of Ron Magni, Mike Hatfield and Lewie Kear take their Midwest sport-scale aircraft around the pylons for a few laps. These three guys really had fast aircraft! Besides missing out on the pylon fun, we also had to cancel a mass launch of all the surviving aircraft (frequencies allowing). Oh, well, maybe next time; although I think the always-devious Signore Tiano has something else planned for the next time. We'll just have to wait and see.

I sincerely thank Pacer Technology, Midwest Products and especially Frank Tiano Enterprises for all their support; it made this event possible. Everyone involved made a point of telling me how much fun they had. I love it when a plan comes together. Nice plan, Frankie! Another sincere thanks to all the participants for coming through in a pinch. You guys really made it happen. Thank you all.

**Addresses are listed alphabetically in the Index of Manufacturers on page 131.* ■

TAILLESS PLANE

(Continued from page 60)

CG, such a stall causes the airplane to nose-up. To permit the SF wing to stall ahead of the CG *first*, so as to cause the plane to nose-down, an increase in the wing's angle of attack toward the tip (wash-in) is desirable. This adds to the wing's twisting tendency and reinforces the need for torsional strength.

It does not require much imagination to see a parallel between this SF wing and a canard configuration:

- In both, lift is upward.
- The canard foreplane and the SF wing's outboard areas must both stall first.
- The aft wing of a canard and the inboard portions of an SF wing must arrive at their angles of zero lift before that of foreplane or outboard panel.

Canard design technology is thus applicable to SF tailless design, with one major difference: the inner portions of the SF wing are not affected by downwash from the outer portions. In canard design, downwash from the foreplane significantly affects the aftplane and is a design consideration.

Part 2 will continue with tailless design. ■

AIRWAVES

(Continued from page 9)

Assuming that all went well, the craft would land nearby on the airport. But if the wind was strong, or if the engine ran longer than expected, we had to rush to the automobile and pray that there was a road going in the general direction in which the aircraft was headed. On occasion, aircraft were lost. A successful flight would end with little more broken than a prop, which we made of blanks cut out on our jigsaws.

Then WW II came and many of us ended up flying in combat. Our interest was easily transferred to flying the real thing. From building models, we began our training with a practical degree in aeronautics. I ended up flying Corsairs in the Marines in the Pacific, where I frequently met model builders.

I often wonder how many modelers took the same course I did, and how many would have equipped their "gas jobs" with R/C, had it been available and had they been able to afford it.

Several months ago, I was telling John McCrady, a master craftsman, dear friend and fellow model maker in the '30s, of the wonders produced by present-day model makers and how insecure I often feel when I view the masterpieces of today. He just laughed and said, "We were the pioneers," and, I might add, we're the old-timers of today.

ERNEST CORNISH BAYNARD
Alexandria, VA

■

INDEX OF MANUFACTURERS

Ace R/C Inc., 116 W. 19th St., P.O. Box 472, Higginsville, MO 64037-0472; (816) 584-7121; fax (816) 584-7761.

Abell Hobby & Mfg. Co., P.O. Box 22573, Billings, MT 59101; (406) 259-4882.

Aeroloft Designs, 2940 W. Gregg Dr., Chandler, AZ 85224.

Aerospan; distributed by Balsa USA (see address below).

Airtronics Inc., 11 Autry, Irvine, CA 92718; (704) 830-8769.

APC Props; distributed by Landing Products, P.O. Box 938, Knights Landing, CA 95645.

ASP; distributed by ISC Intl., P.O. Box 40116, Indianapolis, IN 46240; (317) 844-1978.

Atlantic R/C, P.O. Box 523007, Springfield, VA 22152; (708) 913-7278.

Balsa USA, P.O. Box 164, Marinette, WI 54143; (800) 225-7287; fax (906) 863-5878.

Bob Banka's Scale Model Research, 3114 Yukon Ave., Costa Mesa, CA 92626.

Bob Smith Industries, 8060 Morro Rd., Atascadero, CA 93422; (805) 466-1717; fax (805) 466-3683.

Bob Violett Models (BVM), 170 State Rd. 419, Winter Springs, FL 32708; (407) 327-6333.

Byron Originals, P.O. Box 279, Ida Grove, IA 51445; (712) 364-3165; fax (712) 364-3901.

Carl Goldberg Models, 4734 W. Chicago Ave., Chicago, IL 60651; (312) 626-9550.

Century Jet Models Inc., 11216 Bluegrass Pkwy., Louisville, KY 40299.

Chapis Plans, Rt. 5, Box 848, Seaford, DE 19973; (302) 629-6373.

Composite Structures Technology, P.O. Box 642, Dept MH, Tehachapi, CA 93581; (800) 338-1278.

Coverite, 420 Babylon Rd., Horsham, PA 19044.

Cox Hobbies, 350 West Rincon St., Corona CA 91720; (909) 278-7282.

Dave Platt Models, 1306 Havre N.W., Palm Bay, FL 32907; (407) 724-2144.

Desert Aircraft, P.O. Box 18038, Tucson, AZ 85731.

Don Smith Plans, 219 Goolsby Blvd., Deerfield Beach, FL 33442; (305) 570-7551.

Du-Bro Products, P.O. Box 815, Wauconda, IL 60084; (800) 848-9411.

Dynaflite, P.O. Box 1011, San Marcos, CA 92069.

EMS, 22483 Mission Hills Ln., Yorba Linda, CA 92687; (714) 692-1393.

F&P Model Products, 622 Taylor Ave., Oradell, NJ 07649.

Frank Tiano Enterprises, 15300 Estancia Ln., W. Palm Beach, FL 33414; (407) 795-6600.

Futaba Corp. of America, 4 Studebaker, Irvine, CA 92718; (714) 455-9888.

Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-3630; fax (217) 356-6608.

Glennis Aircraft, 5528 Arboga Rd., Linda, CA 95901.

Global Quality Kits; distributed by Hobby Shack (see address below).

High T.E.K. Models, 461 Houseman N.E., Grand Rapids, MI 49503; (616) 458-2261.

Hobby Poxy, 36 Pine St., Rockaway, NJ 07866; (201) 625-3100; fax (201) 625-8303.

Hobby Shack, 18480 Bandilier Cir., Fountain Valley, CA 92728-8610; (714) 962-0827.

Horizon Hobby Distributors, 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511.

Jerry Bates Plans, 102 Glenwood St., Mobile, AL 36606; (205) 478-6720.

Jet Model Products, 211 N. Mullen Rd., Belton, MO 64012; (816) 331-0356.

Jim Meister Scale Semi-Kits, 993 C-184 S. Santa Fe, Vista, CA 92083.

JR Remote Control; distributed by Horizon Hobby Distributors, (see address above).

K&B Mfg., 2100 College Dr., Lake Havasu City, AZ 86403; (602) 453-3030; (602) 453-3559.

Lanier R/C, P.O. Box 458, Oakwood, GA 30566; (404) 532-6401; fax (404) 532-2163.

Magnum Batteries, Box 223 RR1, Cecil, OH 45821; (419) 399-5561.

Midwest Products, P.O. Box 564, Hobart, IN 46342-0564; (219) 942-1134; fax (219) 942-1134.

Miniature Aircraft USA, 3743 Silver Star Rd., Orlando, FL 32808; (404) 292-4267.

MonoKote; distributed by Great Planes Model Distributors (see address above).

Nelson Competition Engines, 121 Pebble Creek Ln., Zelienople, PA, 16063; (412) 538-5282.

Nick Ziroli Models, 29 Edgar Dr., Smithtown, NY 11787.

O.S. Engines; distributed by Great Planes Models Distributors (see address above).

Pacer Technology, 9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.

Palmer Plans, 6047 Pomegranate Ln., Woodland Hills, CA 91367-7243; (818) 348-0879.

Performance Specialties, P.O. Box 3146, Gardnerville, NV 89410; (702) 265-7523; fax (702) 265-7522.

PFM; distributed by Innovative Products, P.O. Box 4365, Margate, FL 33063.

Prather Products, 1660 Ravenna Ave., Wilmington, CA 90744-1398; (310) 835-4764.

Proctor Enterprises, 25450 NE Eilers Rd., Aurora, OR 97002; (503) 678-1300; fax (503) 678-1342.

Robinaire, 7386 Seabreeze Dr., Lake Worth, FL 33467; (407) 439-6965.

Robart Mfg, P.O. Box 1247, St. Charles, IL 60174; (708) 584-7616.

Rossi; distributed by Sig Mfg. Co., (see address below).

Saito; distributed by Horizon Hobby Distributors, (see address above.)

Sig Mfg. Co., 401 S. Front St., Montezuma, IA 50171; (800) 247-5008; fax (515) 623-3922.

Sullivan Products, P.O. Box 5166, Baltimore, MD 21224; (410) 732-3500; fax (410) 327-7443.

SuperTigre; distributed by Great Planes Model Distributors (see address above).

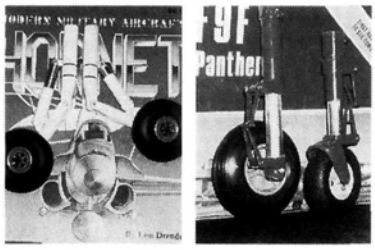
Tekoa: The Center of Design, 49380 Skyharbor Way, Aguanga, CA 92536; (909) 763-0464; fax (909) 763-0109.

Tru-Turn, P.O. Box 836, South Houston, TX 77587; (713) 943-1867.

Yellow Aircraft, 203 Massachusetts Ave., Lexington, MA 02173.

Zenoah; distributed by Indy R/C, 10620 N. College Ave., Indianapolis, IN 46280; (800) 338-4639.

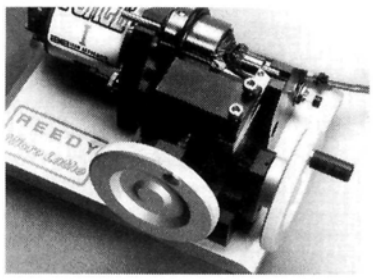
PRODUCT NEWS



R.C. CRAFTERS
Scale Landing-Gear Struts

These scale landing-gear struts were designed for the 1/10-scale, single-engine Yellow Aircraft Hornet; the 1/10-scale Thorpe F-18 Hornet; and the 1/6-scale Nick Ziroli F-9F Panther. Machined of bar-stock aluminum, they can be custom-configured for your gear-actuating mechanisms. These AutoCad-designed struts can be changed to fit your aircraft's size. Please call with your requirements.

R.C. Crafters, 4646 Ashbury Park, North Olmsted, OH 44070; (216) 777-4683.

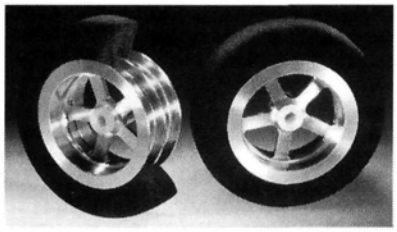


ASSOCIATED ELECTRICS INC.
Comm Lathe

For serious electric fliers, this lathe will work on 05 motors that have standard and lay-down commutator armatures. Compact and easily transported, it's powered by a Reedy stock motor (already installed) running on a 5V power supply or a 6-cell battery pack. The lathe also has a replaceable carbide-insert cutter that has three cutting edges.

Part nos.—SP-300 (lathe); SP-301 (replacement parts); **prices**—$250; $20.

Associated Electrics Inc., 3585 Cadillac Ave., Costa Mesa, CA 92626; (714) 850-9342; fax (714) 850-1744.



PRECISION MODEL PRODUCTS
ProMag Aluminum Wheels

CNC-machined of 6061-T6 bar-stock aluminum, these wheels fit .40- to .60-size aircraft and feature the "Riblock" tire-retention system—a rib that's machined into the hub between the two outer flanges of the wheel that locks into a groove inside the tire. Durable, light, flat-spot-resistant tires are mounted on a 5-spoke mag-wheel design that can be polished to a chrome-like finish. The tires are radiused for smooth ground handling, and replacements are available. ProMags also include replaceable nylon bushings for friction-free running and long wear.

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Featuring quick and easy jig-lock wing construction and a semisymmetrical airfoil for more advanced flying and aerobatics, the Star-Duster has sturdy aluminum landing gear that helps to eliminate bouncing on less-than-perfect landings. This kit's hardware package includes Du-Bro Lazer Rods, CA-type hinges and complete linkages for throttle and all flying surfaces. Specifications: wingspan—60 inches; wing area—665 square inches; weight—4½ to 6 pounds; radio required—4-channel; engine required—.32 to .45 2-stroke or .40 to .50 4-stroke.

Part no.—181; **price**—$134.95.

Midwest Products Co. Inc., P.O. Box 564, Hobart, IN 46342-0564; (800) 348-3497.

HOBBY LOBBY INTL. INC.
Junkers JU 52

This conventional, all-balsa kit is a 1/20-semi-scale model of the German aircraft of the '30s. Wheels, landing gear, ABS-molded cowls and engine housings and a clear-plastic canopy and side windows are provided. Graupner's three-motor and scale-propeller set, running on a single 6- or 7-cell battery back, powers the craft. Specifications: wingspan—59 inches; wing area—403 square inches; length—39 inches; weight—56 ounces; radio required—4-channel.

Part nos.—GR6204; GR6070 (drive unit); **prices**—$158 (introductory); $57.

Hobby Lobby Intl. Inc., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948.

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Miracle Point Pliers

These 4½-inch-long needle-nose and bent-nose pliers are sculptured of 400-series stainless steel and have an exceptionally strong grip. Both pliers are serrated and have built-in cutters and a center groove that grips wire for easy maneuvering.

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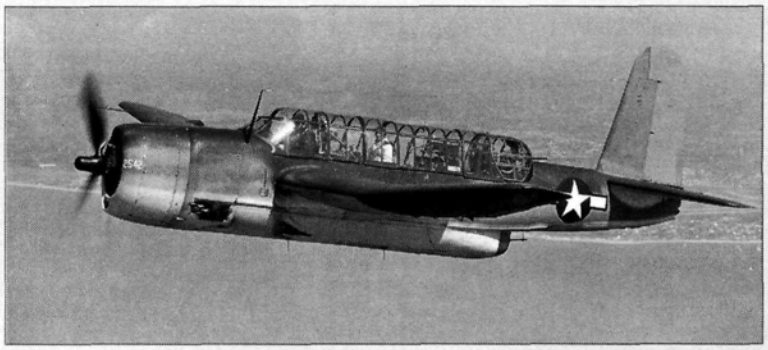
The Media Connection, P.O. Box 71, Crystal Lake, IL 60039; (800) 682-4256.

Descriptions of products appearing in these pages were derived from press releases supplied by their manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News**, nor does it guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News**. **Manufacturers!** To have your products featured here, address the press releases to **Model Airplane News,** attention: Product News, 251 Danbury Rd., Wilton, CT 06897.

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If you can, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.



CONGRATULATIONS to Edward W. Wolak of Moreland, GA, for correctly identifying the January 1995 mystery plane. The Fokker F-25 Promotor was a wooden, four-passenger, twin-boom, cabin airplane that was manufactured by the N.V. Nederlandsche Vliegtuigen-Fabriek Fokker company in the Netherlands in the mid to late '40s.

It had retractable landing gear and hydraulically operated, three-position flaps (takeoff, landing and normal flight). The plane was 27 feet, 10½ inches long and had a 39-foot, 4½-inch wingspan and an empty weight of 2,115 pounds. Maximum air speed at sea level was 141mph, and the range was 492 miles. It was powered by a single Lycoming 0-435A, 6-cylinder, air-cooled engine that was mounted in a pusher configuration and had a maximum horsepower rating of 190 at 2,550rpm. ■

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News**. If already a subscriber, the winner will receive a free one-year extension of his subscription.

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MODEL MOTORS WANTED—Most types, 1970 and earlier. Cash or trade. T. Crouss, 100 Smyrna, West Springfield, MA 01089. [3/95]

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ANTIQUE IGNITION-GLOW PARTS CATALOGUE, 1/2-inch thick, timers, needle valves, cylinder heads, pistons, points, tanks, spark plugs, racecar parts. Engines: 1/2As, Baby Cyclones, McCoys, Phantoms, etc. $8 postpaid (U.S.); $20 foreign, Chris Rossbach, R.D. 1, Queensboro Manor, Box 390, Gloversville, N.Y. 12078. [8/95]

SODA-CAN AIRPLANES—replica biplane detail plans with photos $7.50 PPD, Early's Craft, 15069 Valley Blvd. SP 26, Fontana, CA 92335. [8/95]

CARS. Selling model collection, 1973 issues up, 1/24-1/25, individual prices, about 800. Ralph, Box 2423-P, Yakima, WA; (509) 965-0670. [5/95]

DO YOU SPEAK MODEL AIRPLANE? Seventy years of aeromodeling history! All the heroes, contests, models! Paperback, 320 pages, $19.95 postpaid. Also: Old Buzzard's Soaring Book, $16.95. Dave Thornburg, 5 Monticello, Albuquerque, NM 87123; (505) 299-8749 for Visa/MC [6/95]

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MAGAZINE BACK ISSUES—*American Modeler, American Aircraft Modeler, Aeromodeller, Model Airplane News, Model Aircraft, RCM* and more; 1930s–1990s. For list, send SASE to Carolyn Gierke, 1276 Ransom Rd., Lancaster, NY 14086. [3/95]

WANTED: OLD, ready-to-run, gas-powered cars, airplanes and boats. Complete or parts. Please write: Dean Barham, 4032 Iowa St., San Diego, CA 92104; (619) 528-1680. [3/95]

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MODEL BOATS: buy, sell, trade, search, restore, or custom-build. Bob Langert, 2350 250th St., Space #30, Lomita, CA 90717; (310) 326-9106. [5/95]

HISTORIC REPLICAS: Flying Tigers, 94th Aero, Lafayette Escadrille accessories; pilot sport shirts, T-shirts, wings, medals, beer steins, scarves; WW I squadron pins–from $4.95. Free gift with order. Catalogue–$1 (refundable). Company of Eagles, 875A Island Dr., Ste. 322N, Alameda, CA 94502. [3/95]

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INTERNATIONAL AIRCRAFT RESEARCH. Need documentation? Include name of aircraft (for availability of documentation) and $3 for three-view and photo catalogue. 1447 Helm Ct., Mississauga, Ontario, Canada L5J 3G3. [4/95]

WANTED: Model engines and racecars before 1956. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105; (806) 622-1657. [12/95]

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GEE BEE Plans (Benjamin used); 1/3, 1/4, smaller; "Z," R-1, R-2, "Bulldog," "Goon," "Firecracker," monocoupes, Culver, Rearwin, airplane shirts, caps, coasters, wall decor! Big catalogue/news, $4 (refundable). Clements, 308 Palo Alto, Caldwell, ID 83605; (208) 459-7608. [4/95]

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VIDEOS: Top Gun '94, R/C Know How beginners' guide, North Carolina Big Bird Fun Flys; each, two hours long. Send $19.95 plus $3 S&H to E&H Video, 134 Wildwood Dr., New Bern, NC 28562. NC residents add $1.20 tax; (919) 637-3416. [4/95]

WANTED: Pilot kit. Bellanca Super Decathlon 8' span (Japan). Donald Brann, 37785 Amber Dr., Farmington Hills, MI 48331; (810) 553-6711 Eve., (810) 543-1950 day. [3/95]

WANTED: To buy 12-inch G.I. Joe's. Have R/C for trade, or will buy them. Jeff Gilbert, 423 S. Randolph St., Princeton, IL 61356-1960; (815) 875-1653. [5/95]

WANTED: Old, unbuilt, plastic model kits from '50s and '60s. Send list, price to Models, Box 863, Wyandette, MI 48192. [2/97]

NEW ZEALAND AERO PRODUCTS—Scale plans: Pawnee Brave, Pawnee, Airtruk/Skyfarmer, Agwagon, Fletcher FU-24, Cessna Aerobat, DC-3/C-47, Typhoon, Hall's Springfield Bulldog, Fairchild PT-19/Fleet PT-26, Rearwin Sportster and more. Fiberglass parts, hardware paks, color photo paks available. Free documentation with plans. Catalogue/price list: $5 (U.S.); Visa/MC. 34 Ward Parade, Stirling Point, Bluff, New Zealand. Phone/24 hr. fax—0064-03-212-8192. [2/96]

FOR SALE: Der Jagger RTF ($1,900); Der Jagger RTF ($1,450); Fly Baby RTF ($900); Fly Baby Folding Wings RTF ($1,840); 1/5-Scale P51 all Servos, Retracts ($1,500); 1/4 Scale P51 all Servos, Retracts ($2,900), F-15 RTF Byron OS91 Dynamax Fans ($2,600); F-14 RTF ($3,500); 12-foot Telemaster RTF ($1,200); Curtis Falcon RTF ($1,800); 1/5-Scale Spitfire RTF ($1,600); PT19 RTF ($1,800); Stinger Kit ($120); Stinger Kit ($120); Bleriot Full Scale ($2,200); D-18 RTF Full Scale all options ($700); Phantom Jet OS91's Dynamax Fans PCM Radio ($3,350). Call after 5:00 Mon-Fri, all day Sat, Sun.; (609) 871-7559. [6/95]

WANTED: Futaba Single-Stick Radio PCM Helicopter System—whole system or transmitter only. Bob Vomero; (814) 825-8404. [3/95]

NASA-STYLE MODEL DESIGN—Analyze and display your model showing flight pressures in changing colors. Computes integrated lift, drag, power, info pack w/ demo disk—$10. Synergium, Dept. M, P.O. Box 21481, Tampa, FL 33622. [5/95]

ENGINES, KITS & ACCESSORIES: 35-year collection for sale. For listing send #10 SSAE to: Ed Hagerlin, Box 1980, Overton, NV 89040. [5/95]

SIG SPACEWALKER 1/3-scale, red/yellow, Supertiger 3000, Futaba 8S GAP w/2 receivers, gold stickered, $1175.00. Greg Liskey, Rt. 4, Box 188C, Elkton, VA 22827; (703) 289-9633. [4/95]

WANT TO BUY: Old Cox, Wen-Mac, etc. Dealer catalogues, brochures, or signs. Thanks. Dean Barham, 4032 Iowa St., San Diego, CA 92104; (619) 528-1680. [5/95]

TURBINE-POWERED F-16 Falcon, original AMA testbed with new engine, Futaba radio, proportional brakes, all white with red and black trim. Ready to fly. Please, serious inquiries only. Bob Fiorenze, (407) 327-6353. [4/95]

AERO FX BY JO DESIGNS—exact-scale, computer-cut, high-performance vinyl graphics and paint masks. Lettering; nose art; insignia for scale; pattern, pylon and sport fliers; complete graphic sets available. Call or write for free sample and catalogue. JO Designs, Rt. 1, Box 225 AA, Stratford, OK 74872; (405) 759-3333; fax (405) 759-3340. [5/95]

HOBBY SHOP BUSINESS FOR SALE. Excellent opportunity. Inventory and equipment included. R/C cars, airplanes, trains, models, rockets, etc. Call Connie Johnson, (800) 255-1917. [4/95]

MICROLITE DETHERMALIZER .7 gram. Send large SASE to Wheels and Wings, P.O. Box 762, Lafayette, CA 94549-0762. [9/95]

MOBILE FIELD FLY BOX. Mr. Housefly offers you plans to build your own Mobile Field Fly Box. It can carry your fuel can, battery pack, starter, power panel, fuel pump, transmitter, spare props, tools and your model. You can start your engine right on the Fly Box; you don't have to get on your knees. Price—$21.95 (includes S&H). Contact Mr. Housefly, 1008 W. 6th St., Ida Grove, IA 51445; (712) 364-3596. [6/95]

R/C AERIAL FILM MAKING. Plans of Adrian and Hugh Kingsfords unique camera lifting models, as featured in "R/C Airborne Videos" Pterodactyl, hand-launched video delta. Loftus, multi-role photographic vehicle. Phoenix II, 14-foot-span professional filming plane. Info pack/price list $5 (US); 12 Toru St., Mapua, Nelson, New Zealand; (03) 540 2577. [5/95]

WANTED: airplane training software IBM compatible. 3.5 of 5.25 disk. Adelman, 7713 Kilbourn, Skokie, IL 60076; (708) 679-0308. [4/95]

1992 NATS VIDEO. Two-hour documentary includes R/C and C/L scale, C/L carrier, R/C helicopters, R/C pylon racing, C/L combat, Speed and aerobatics, free flight indoor and outdoor. Includes interviews with fliers and officials, Voice-overs and original music. $29 (S&H included), NY add 8.25% to: Alan Abriss Productions, 94-20 66th Ave., Forest Hills, NY 11374. [6/95]

GIANT-SCALE PLANS—108-inch Shelton Crusader; 118-inch Sikorsky S-42 Clipper; 88-inch Dornier DO-24; 118-inch Dornier DO-26; 114-inch Northrop Gamma; 103-inch Blohm Voss HA-140. Additional seaplanes available. Two stamps for information. Sea-Clusion Aeronautics, Gene Falada, 22W 070 Byron, Addison, IL 60101. [4/95]

DOCUMENTATION PHOTOS & Scale Drawings. Boddington color pacs, Fred Spring Spitfire, Mosquito, Hornet scale drawings. SAE for lists. Best in Scale catalogue—$6. Bob Holman, Box 741, San Bernardino, CA 92402; (909) 885-3959. [4/95]

LARGE COLLECTION of *MAN, FM, Air Travel* and more. From 1937. Approximately 600 magazines. Reasonable offers considered for collection. Call (612) 473-9354. [6/95]

FUN-SCALE FORMULA V. Full-size plans of original VW-powered formula sport racer, Five sizes up to ¼ scale; engine sizes 10 to 60. Excellent flight characteristics with symmetrical airfoil. Limited offer. All five sets of full-size plans plus material list for $25. Info. send SASE to: Richard Jameson, 2328 Waco Ave., Placentia, CA 92670. [6/95]

HELICOPTER WANTED. Schluter Futura trainer used, without engine or radio. Will consider crash if price compensates for repairs. Also, Schluter Moskito. Please send letter and state condition, price and address to: E. Perera, 1293 Comm. Ave., Allston, MA 02134. [4/95]

WW I PLANS. Over 400 in stock. Peanut to 100 inches. Send three, $1.00 bills for illustrated catalogue to Clarke Smiley, 23 Riverbend Rd., Newmarket, NH 03857. [9/95]

FIVE DAYS of hands-on instruction with X-Cell helicopters, Futaba and JR computer radios. Small classes, tailored to your individual needs, beginner to expert. Includes all meals and lodging. Over 380 students from 23 countries and 43 states, logging 14,500 flights in the last five years. Located on a 67-acre airport used exclusively for R/C training. Owned and operated by Ernie Huber, five-time National helicopter champion. Send for free information and class schedule NOW! P.O. Box 727, Cresent City, FL 32112; ph. (800) 452-1677, fax (904) 698-4724. Outside U.S., phone (904) 694-4275. [6/95]

WANTED: working Ace Pulse-Proportional R/C system, Albin Receiver and Bentert Magnetic Actuator. Edward Jones, 10405 Button Quail Dr., Austin, TX 78758-5032; (512) 837-8041. [5/95]

R/C FLIGHT TRAINING. Your training is fun and easy in far western North Carolina, near Murphy on your map. Write or call. R/C Flight Training, 120 Setawig Rd., Brasstown, NC 28902; (704) 389-8968. [6/95]

BOB FIORENZE BUILDING SERVICE. Jets, warbirds and helicopters. Contact Bob at (407) 327-6353. Our experience is your best assurance. [6/95]

WANTED: toy metal outboard boat motors, Gale, Oliver, Mercury, etc. Also tin toy boats, robots, motorcycles, racecars, gas-powered model racecars, pre-1950 model-airplane motors. Richard Gronowski, 140 N. Garfield Ave., Traverse City, MI 49686; ph. (616) 941-2111. [4/95]

FINAL APPROACH

THE UNIQUELY EXCLUSIVE SITAR

AS INCREDIBLE as it may seem, the third most popular helicopter flown at the last world championships—held in Austria—was produced by arguably the world's most exclusive model helicopter manufacturer—Herbert Sitar. In Europe, his products are considered jewels of manufacturing excellence and performance. His is one of the remarkable stories in European modeling.

Herbert Sitar (right) and Guy Revel with a Sitar Speedycopter—Herbert's latest competition machine—at the 1993 R/C Helicopter World Championships in Velden, Austria. It uses an original body.

PIONEERING IN COMPOSITES

Back in the '70s, a small group of Austrian modelers created excitement in F3B glider competition circles. They had developed what was later acknowledged to be *the* major model design and technological breakthrough of the past 50 years—the molded composite model.

I first met this group in 1976 when they entered their first competition. I was, at that time, a keen F3B soaring competitor, and every international competition in Europe was another opportunity to see them and their famous glider—the Dassel.

The technology had been refined since 1971, when they had produced their first fully molded sport model, which they flew on the slopes of the high mountains surrounding Innsbruck, Austria. Within a few months of entering their first competition, their models' performances had made them famous. A speed glider flown by team member Werner Sitar captured the absolute world speed record by flying an incredible 244mph.

The team represented Austria at the 1979 Soaring World Championships in Amay, Belgium, where team member Tony Wackerle finished second. In a number of symposia, they explained their building techniques to fascinated audiences. In later studies of the Dassel wing's aerodynamics—at the Zurich Polytechnical Institute and the world-famous Stuttgart Aerodynamics Institute—its accuracy was found to be within 0.0008 inch of the theoretical ordinate values. With nothing more to prove, the team stopped competing and resumed their usual activity—flying only for pleasure without the pressure of competition.

A SWITCH TO HELICOPTERS

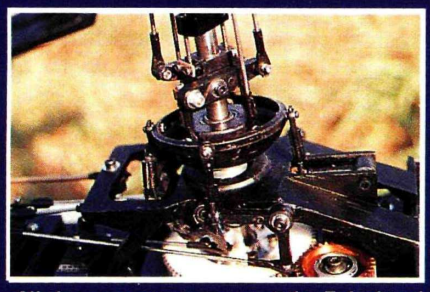
At this time, team member Herbert Sitar, who was interested in R/C helicopters, began making rotor blades using the lessons learned from producing accurately molded glider wings. These blades were the first to be fully molded and built out of composite materials; they're still used by leading competitors all over Europe.

Herbert built his first scratch-built helicopter in 1981. Truly a work of art, every piece was hand-molded of carbon fiber and epoxy resin. He was asked to build and sell a similar machine, and then another, for enthusiastic competitors. Thus began the world's most exclusive R/C helicopter manufacturer.

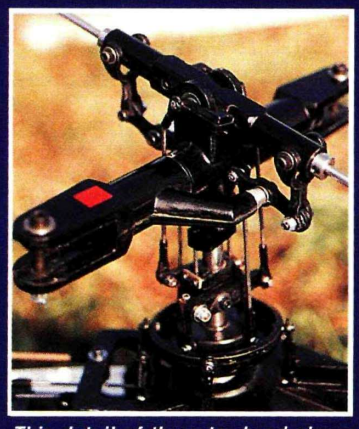
In 1982 came a Lockheed and a Jet Ranger, and then in 1984, a Bell 222. The Speedycopter is the latest creation; it was introduced at the 1992 European Championships, and it was flown by seven competitors at the last World Championships. Flying a Speedycopter is a privilege because the machine is entirely handmade, and there's a long waiting list; only 25 are produced each year! And if you really want one, you'll have to take 6,000 Swiss francs (more than $4,000 U.S.) out of your pocket.

Despite his growing helicopter business, Herbert Sitar didn't leave his work at Innsbruck University; he produces his helicopters (and his annual 2,000 sets of rotor blades) mainly at night. Needless to say, no other R/C helicopter manufacturer has such low production with such fame. The accompanying photographs show some of the details of this remarkable machine. —*Guy Revel*

The mechanics are easily removed from the body: the engine is mounted on machined-metal bearers outside of the main frame; a toothed belt drives the clutch; the entire model is assembled with only 42 hand-made, carbon-cloth, tow and epoxy-resin parts (including all the levers!). The rear rotor-drive mechanism can be seen at the bottom of the photo.



All the components—except the Tufnol and Delrin gears, the reinforced plastic ball links and the mandatory metal parts such as the rotor mast, the ball bearings and the screws—are made out of carbon composite. The main frame halves are not made out of the usual simple plates: they're a complex structure that holds the gear train and the rotor mast—similar to the system that's used on Heim helicopters.



This detail of the rotor head shows the mixing fork and lever; ball bearings are used everywhere. Because of the carbon-composite structure, the rotor head is lighter than a plastic head but as rigid as a metal machined one.